Updates to Operations, Maintenance, and Monitoring Plans

Alcoa (Point Comfort)/Lavaca Bay Superfund Site

February 2019

Alcoa

100024817

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LIST OF ACRONYMS AND ABBREVIATIONS

CAPA	Chlor-Alkali Process Area
CD	Consent Decree
DNAPL	dense nonaqueous phase liquid
FS	Feasibility Study
OMMP	Operations, Maintenance, and Monitoring Plan
PAH	polycyclic aromatic hydrocarbon
RAO	Remedial Action Objective
RDR	Remedial Design Report
ROD	Record of Decision
Site	Alcoa (Point Comfort)/Lavaca Bay Superfund Site
SOP	standard operating procedure
TCEQ	Texas Commission on Environmental Quality
USEPA	U.S. Environmental Protection Agency

1 INTRODUCTION

Performance monitoring is conducted at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site (Site) in Point Comfort, Texas, to satisfy the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act Consent Decree (CD)/Statement of Work between Alcoa, the United States of America, and the State of Texas, entered in the United States District Court, Southern District, on the effective date of March 1, 2005 (United States et al. 2005). The CD specifies certain performance monitoring activities to evaluate the effectiveness of the remedy and meet Remedial Action Objectives (RAOs). The scope for these monitoring activities is contained in the Remedial Design Reports (RDRs) and Operations, Maintenance, and Monitoring Plans (OMMPs) attached to the CD. Reporting to the U.S. Environmental Protection Agency (USEPA) and the Texas Commission on Environmental Quality (TCEQ) is performed on an annual basis.

The original RDRs and OMMPs described the operations, maintenance, and monitoring programs for the following remedy components (Alcoa 2003a, 2003b):

- Chlor-Alkali Process Area (CAPA) Groundwater
- Former Witco Tank Farm Dense Nonaqueous Phase Liquid (DNAPL) Containment System
- North of Dredge Island Enhanced Natural Recovery [1]
- Dredge Island
- Witco Marsh Remediation [2]
- CAPA Soils
- Witco Area Soils
- Lavaca Bay Sediment Remediation and Long-term Monitoring Plan
- Lavaca Bay Finfish and Shellfish

The objective of this document is to encapsulate the current performance monitoring activity scope for the Site. Section 2 summarizes the updated OMMPs. Appendices A1, B1, C, D, E1, E2, and F contain the original OMMPs with cover pages summarizing updates to the original versions. Appendix A2 contains current Standard Operating Procedure (SOPs) for sediment monitoring. Appendix B2 contains current SOPs for finfish and shellfish monitoring.

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[1] The thin-layer capping remedial action was not constructed as open water sediment remediation goals were achieved in 2004 and 2005 (Alcoa 2006). Therefore, the associated monitoring activities described in the original OMMP were not conducted and are not necessary. See Section 2.6.

[2] Witco Marsh remediation was completed in 2006, and ongoing monitoring is discussed under Section 2.1.2 of this report.

2 SUMMARIES OF UPDATED OMMPS

This section summarizes the current OMMPs for the Site. For details, the reader is referred to the appendices, which contain the original OMMPs with changes documented on the cover page of each OMMP.

2.1 Sediment

As described in Appendix A1, the Closed Area sediment monitoring program was designed to evaluate surface sediment mercury concentrations within the limits of the designated open water and marsh areas.

2.1.1 Open Water

The RAO for open water sediment monitoring for the Closed Area was met in 2004 and 2005 (Alcoa 2006), and open water sediment monitoring is no longer required. However, with USEPA concurrence, Alcoa has periodically collected open water sediment samples to assess conditions. Alcoa plans to perform this monitoring effort on a biannual basis following the same procedures as those utilized in 2017 (Appendix C2 of Alcoa 2018). Thirteen open water sediment samples will be collected from the top 2 centimeters of sediment at sample stations located in East Causeway Cove (Figure 2-1). Sediment samples will be analyzed for mercury and percent moisture. USEPA will be notified of any modifications to the scope or frequency of this sampling program.

2.1.2 Marsh

The RAO for marsh sediment monitoring has been met for all Closed Area marsh locations,[3] and monitoring of these locations is no longer required. In addition, many of the marsh grass areas have been removed via excavation or herbicide application, as approved by USEPA.

Alcoa will continue to apply herbicide to prevent marsh grasses from re-establishing (Figure 2-2) on a periodic basis. During the growing season (March through November), Alcoa will evaluate marsh grass conditions once per month and spot treat emergent vegetation. USEPA will be notified of any modifications to the scope or frequency of this monitoring/application program.

[3] The final marsh achieved the RAO in fall 2015 (Alcoa 2016). Other marshes had achieved the RAO in previous years.

2.2 Finfish and Shellfish

Annual monitoring of finfish and shellfish tissues for total mercury is required to demonstrate the effectiveness of remedial actions implemented at the Site and to document the recovery of fish tissue mercury levels. The monitoring program is a continuation of the previous OMMP and utilizes the same currently approved sampling strategy and analytical techniques; changes that had already been made to the original OMMP are documented in the cover page of Appendix B1. Alcoa will collect and process for analysis 30 red drum samples and 30 juvenile blue crab samples from the Closed Area; and 30 red drum samples and 30 juvenile blue crab samples from the Open Area adjacent to the Closed Area (Figures 2-3A through 2-3D). Tissue samples will be analyzed for total mercury.

2.3 Chlor-Alkali Process Area Groundwater

Extraction and treatment of mercury-contaminated groundwater at the CAPA is a component of the Bay System remedy, as described in the Feasibility Study (FS; Alcoa 2001) and required by the ROD (USEPA 2001). Appendix C presents an overview of the CAPA groundwater treatment system and the objectives of the monitoring program.

Appendix C provides an overview of the remedial design of the system and a description of the operation and monitoring performed, including inspections, sampling, and periodic maintenance (e.g., carbon canister changeouts, system repairs). Operation, maintenance, and monitoring of the CAPA groundwater extraction and treatment system are conducted in accordance with the original RDR and OMMP (Appendix C), and sampling data are still compared to the discharge standards developed initially. As described in the cover page to Appendix C, Lavaca Bay surface water monitoring (i.e., the sampling of surface water offshore of the CAPA) was discontinued in 2007 after sampling results for mercury and carbon tetrachloride demonstrated effective hydraulic control by the groundwater treatment system when compared to the State of Texas Surface Water Quality Standards over a 9-year period (Alcoa 2007).

2.4 Chlor-Alkali Process Area Soils

Soils in the immediate vicinity of Building R-300 at the CAPA were identified during the remedial investigation as having mercury concentrations above risk-based values, and soils with a mercury concentration greater than 466 milligrams per kilogram were capped, as described in the FS (Alcoa 2001) and required by the ROD (USEPA 2001).

Appendix D presents an overview of procedures for monitoring the soil cap, including inspections and periodic maintenance (e.g., vegetation control and cap repairs), which will continue to be implemented. Periodic inspections will occur semiannually and also on an as-requested or as-needed basis.

2.5 Former Witco Tank Farm DNAPL Containment System and Witco Area Soils

Containment of DNAPL-containing polyaromatic hydrocarbons (PAHs) and capping of PAH-impacted soils at the Former Witco Tank Farm Area are components of the Bay System remedy, as described in the FS (Alcoa 2001) and required by the ROD (USEPA 2001). Maintenance and monitoring of the Former Witco Tank Farm remedial actions will continue in accordance with the original RDR and OMMP (Appendices E1 and E2). Periodic inspections will occur semiannually and also on an as-requested or as-needed basis.

2.6 North of Dredge Island Enhanced Natural Recovery

Thin-layer capping of the area north of Dredge Island was included as a component of the comprehensive Site remedy to enhance natural recovery of open water sediments as described in the FS (Alcoa 2001) and the ROD (USEPA 2001). However, based on the results of open area sediment monitoring conducted from 2004 through 2005 (that indicated the RAO for open water sediment had been met [Alcoa 2006]), and in 2006 (confirming that natural recovery of sediments is occurring in the area [Alcoa 2007]), thin-layer capping of the area north of Dredge Island was eliminated from the overall Site remedy. This decision was finalized in the Explanation of Significant Differences, Alcoa (Point Comfort)/Lavaca Bay Site (USEPA 2007).

2.7 Dredge Island

Appendix F provides an overview of the Dredge Island remedial design of the removal action completed in 2001 and a description of the maintenance and monitoring performed, including inspections and periodic maintenance (e.g., dike repairs, vegetation removal). Maintenance and monitoring of Dredge Island are conducted in accordance with the original OMMP (Appendix F). Periodic inspections will occur semiannually and also on an as-requested or as-needed basis.

3 REFERENCES

Alcoa, 2001. *Feasibility Study, Alcoa (Point Comfort)/Lavaca Bay Superfund Site*. May 2001.

Alcoa, 2003a. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.

Alcoa, 2003b. *Lavaca Bay Finfish and Shellfish Operations, Maintenance, and Monitoring Plan*. October 2003.

Alcoa, 2006. *2005 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 3, 2006.

Alcoa, 2007. *2006 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 30, 2007.

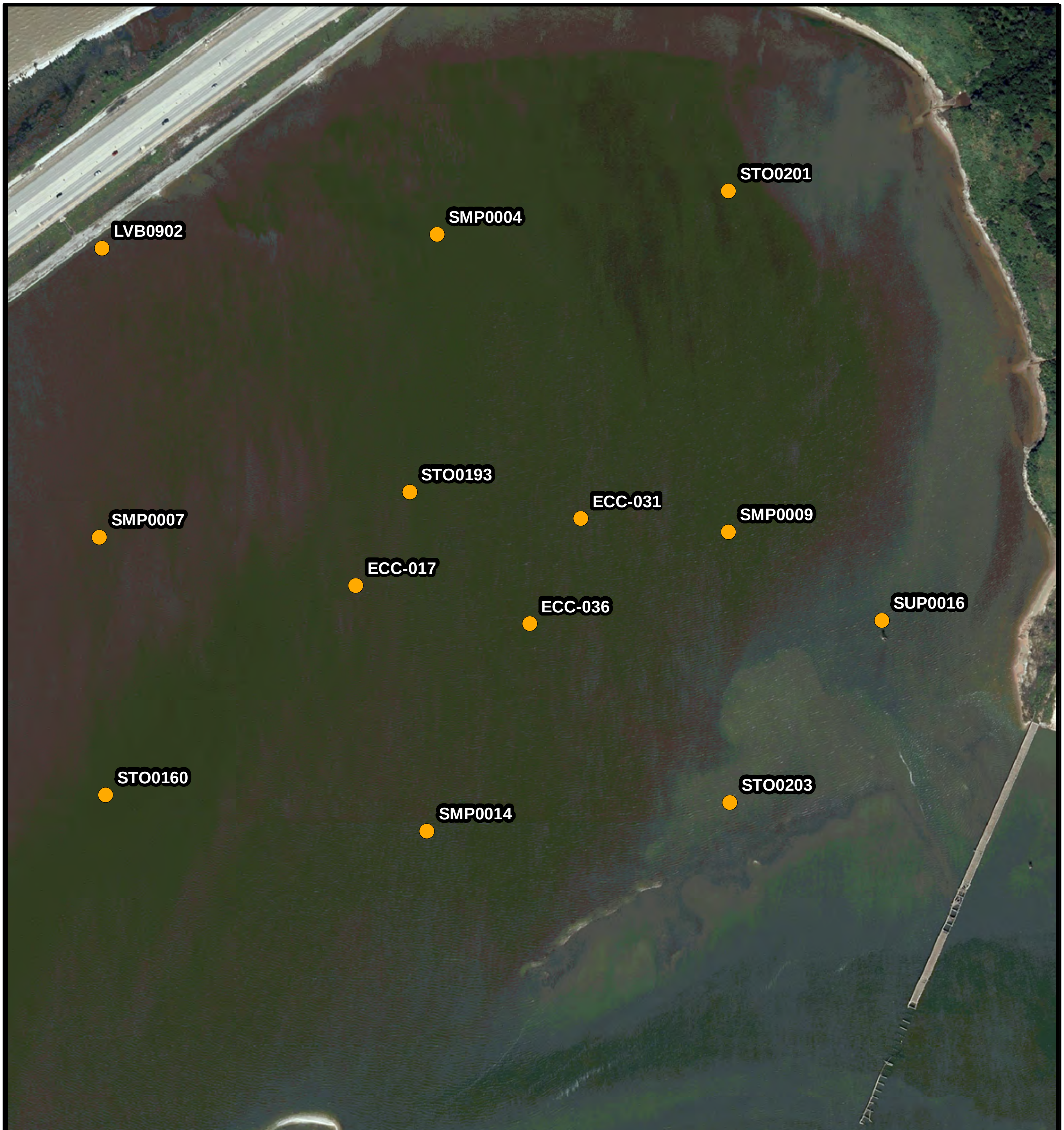
Alcoa, 2016. *2015 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 31, 2016.

Alcoa, 2018. *2017 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 2018.

United States et al. v. Alcoa Inc., et al., 2005. Consent Decree for CERCLA Response Actions and Response Costs (Civil Action Number V: 04-CV-119). February 2005.

USEPA (U.S. Environmental Protection Agency), 2001. Record of Decision for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site. December 2001.

USEPA, 2007. Explanation of Significant Differences, Alcoa (Point Comfort)/Lavaca Bay Site, CERCLIS # TXD 008123168. May 2007.



N

0 125 250 500
Feet

Legend

Open Water Sediment Sample Locations

Notes

2018 Lanmon Imagery

Sediment Annual Monitoring

Map of Open Water Sediment Sampling Locations

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-091

Date: 1/16/2019

Figure 2-1

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0 500 1,000 2,000

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Legend

Marshes to be treated with herbicide

Notes

Lanmon Aerial Imagery 2018

Sediment Annual Monitoring

Map of Marshes to be Treated with Herbicide

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-091

Date: 1/16/2019

Figure 2-2

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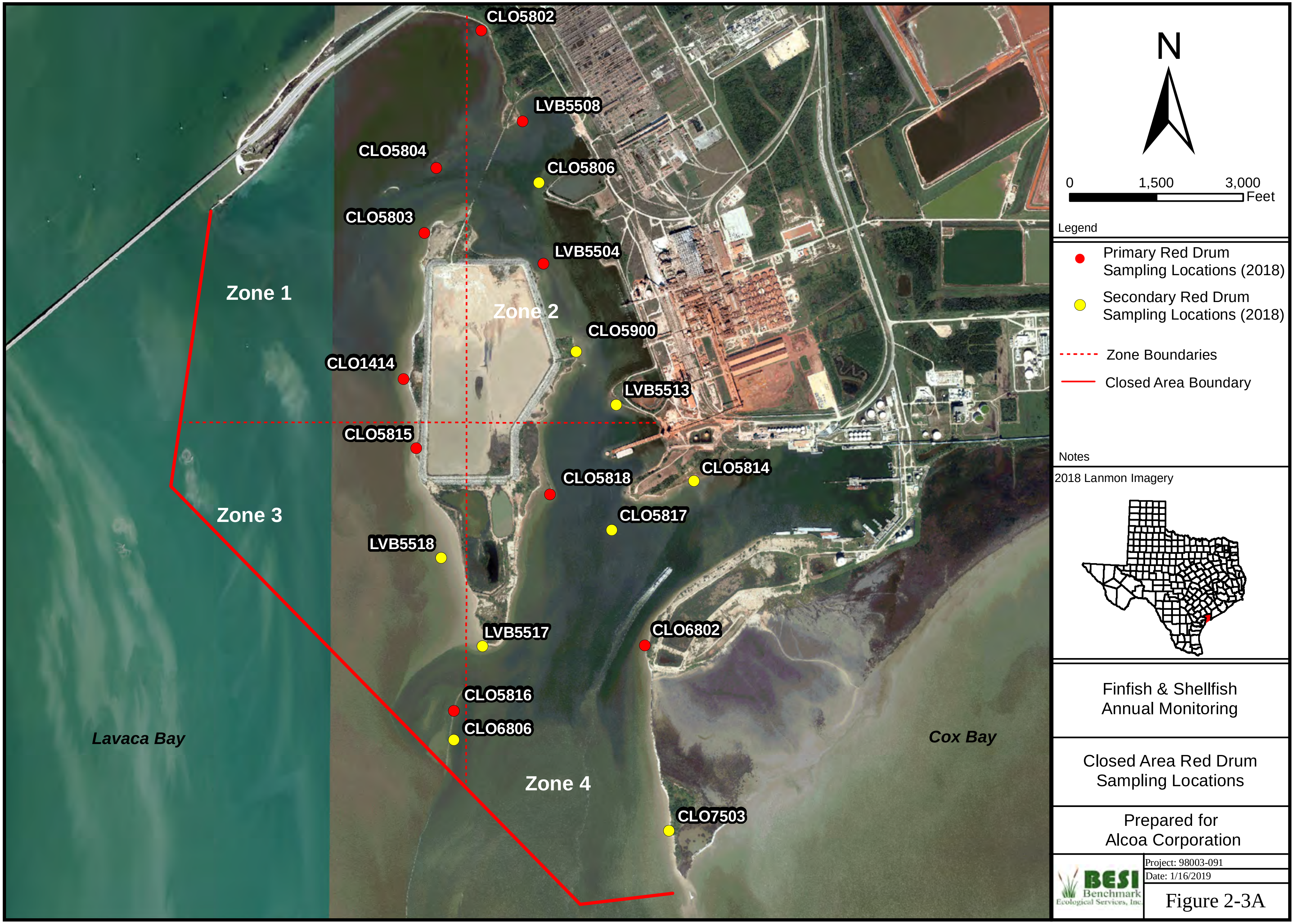

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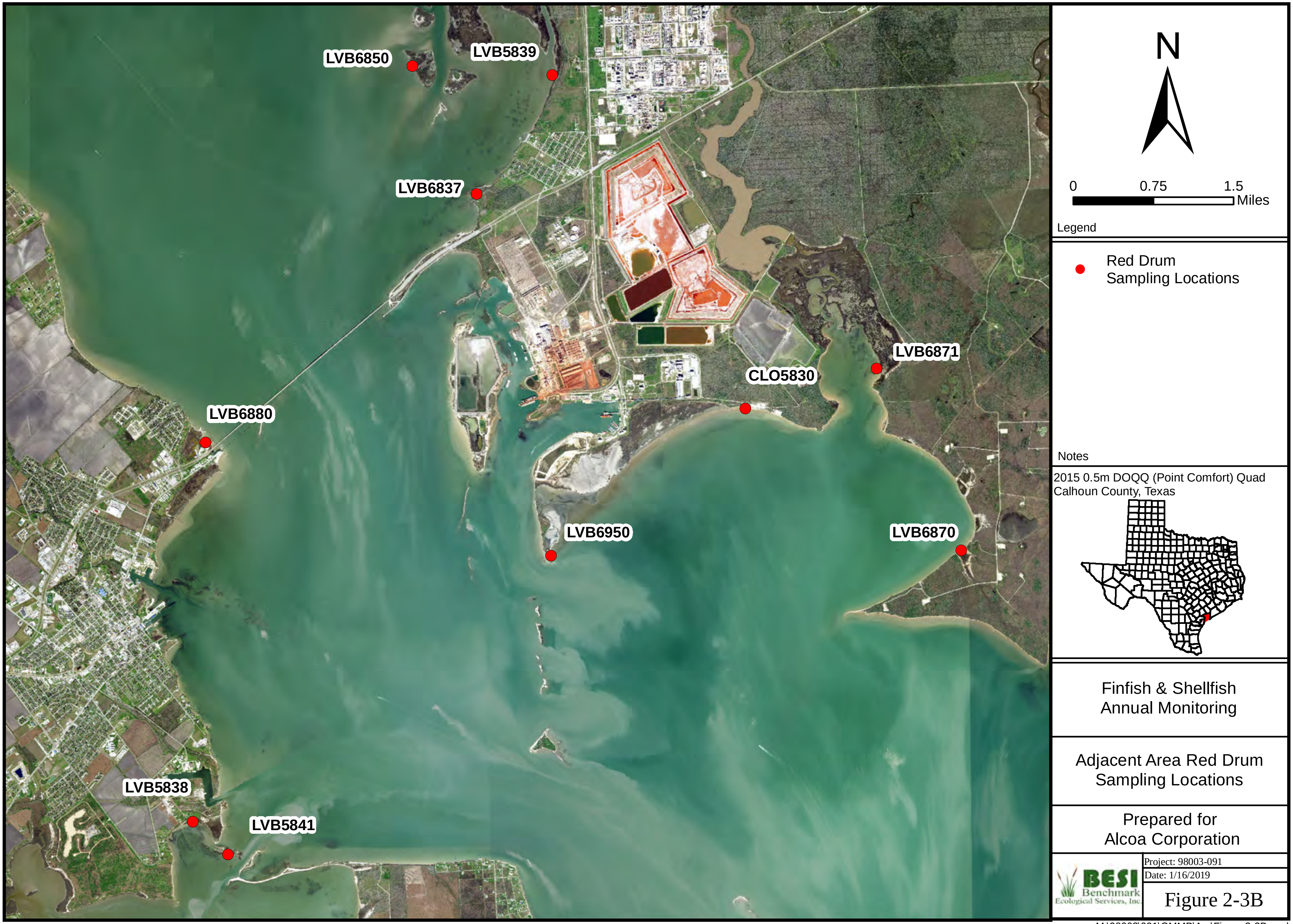

Finfish & Shellfish
Annual Monitoring

Adjacent Area Red Drum
Sampling Locations

Prepared for
Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-091
Date: 1/16/2019

Figure 2-3B

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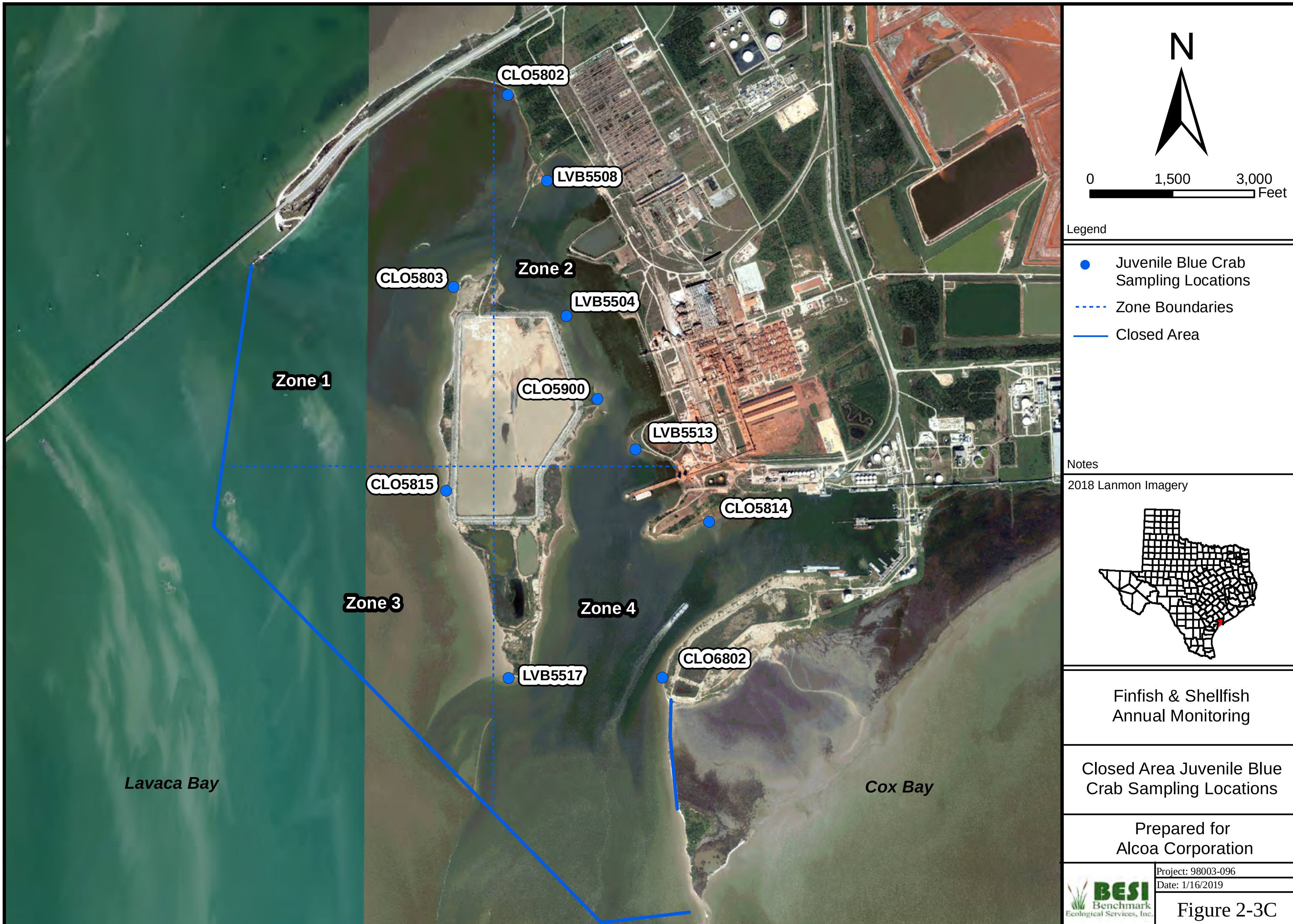

Finfish & Shellfish Annual Monitoring

Closed Area Juvenile Blue Crab Sampling Locations

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-096

Date: 1/16/2019

Figure 2-3C

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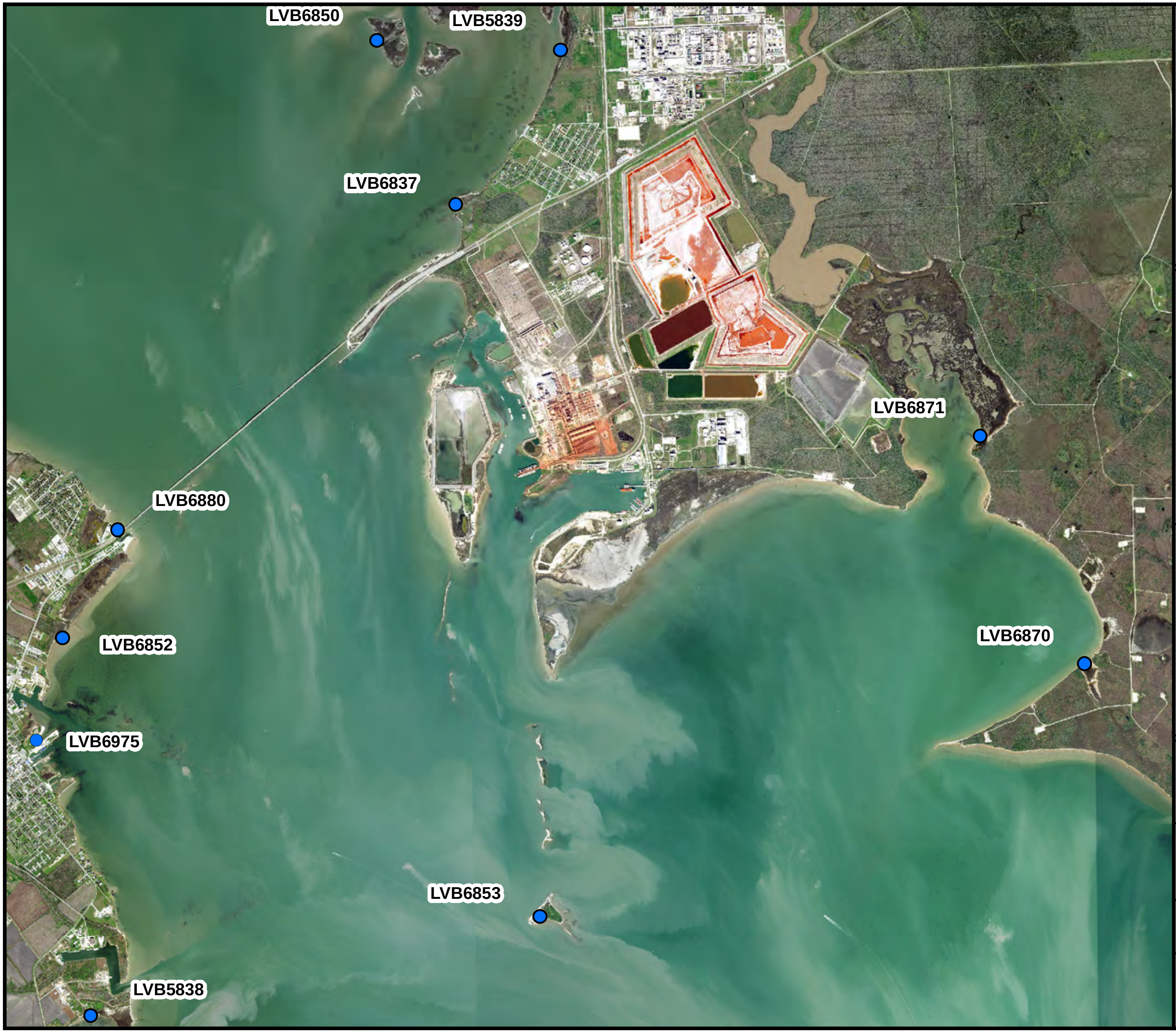

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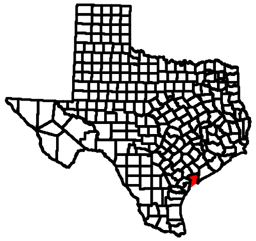
0 0.5 1 Miles

Legend

Juvenile Blue Crab Sampling Locations

Notes

2015 0.5m DOQQ (Point Comfort) Quad
Calhoun County, Texas



Finfish & Shellfish Annual Monitoring

Adjacent Area Juvenile Blue Crab Sampling Locations

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-091
Date: 1/16/2019

Figure 2-3D

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UPDATE TO LAVACA BAY SEDIMENT REMEDIATION AND LONG-TERM MONITORING PLAN, OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix A1 to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Operations, Maintenance, and Monitoring Plan (OMMP) for sediment monitoring from September 2003.[1] The following describes the current protocols for open water sediment sampling and marsh sediment treatment.

1 OPEN WATER SEDIMENT

The Remedial Action Objective (RAO) for open water sediment monitoring for the Closed Area was met in 2004 and 2005,[2] and open water sediment monitoring is no longer required. However, with U.S. Environmental Protection Agency (USEPA) concurrence, Alcoa has periodically collected open water sediment samples to assess conditions. Alcoa plans to perform this monitoring effort on a biannual basis following the same procedures as those utilized in 2017 (Appendix C2 of Alcoa 2018[3]). Thirteen open water sediment samples will be collected from the top 2 centimeters (cm) of sediment at sample stations located in East Causeway Cove (Figure 2-1 in the main report). USEPA will be notified of any modifications to the scope or frequency of this sampling program.

The top 2 cm of sediment will be subsampled using an Ekman grab sampler (SOP-BESI-105 in Appendix A2 to the main report) and a clean, disposable, 60-milliliter syringe (SOP-BESI-125 in Appendix A2 to the main report). The subsample will then be placed in a labeled, 4-ounce sample jar provided by the laboratory. The lower end of the syringe barrel (needle lock) will be cut off to transform the syringe barrel into an open cylinder. The open end of the syringe barrel will be placed on the surface of the sediment and, while holding the syringe piston stationary, the barrel will be depressed 2 cm to collect a 0- to 2-cm-depth sub-sample. The syringe will be marked at 2 cm to ensure the proper depth is collected. Three sub-samples will be removed from each Ekman grab sampler to provide the volume of sediment required for analysis. New (clean) syringes will be used to collect and process each sample, and the sub-samples will be homogenized thoroughly by shaking the sample jar. Sediment will be analyzed for mercury and percent moisture.

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[1] Alcoa, 2003. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.
[2] Alcoa, 2006. *2005 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 3, 2006.
[3] Alcoa, 2018. *2017 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 2018.

Sample jars will be labeled with the sampler's initials, sample ID, collection date, time, and the intended analyses. Then, the sample jars will be placed in resealable plastic bags, bubble wrapped, and immediately placed in an insulated chest for storage and transport. Chain of Custody forms will be completed for all samples collected and processed (SOP-BESI-501 in Appendix A2 to the main report).

Issues related to the health and safety of project personnel will be addressed prior to initiation of field activities through review and revision of Health and Safety Plan addenda documents and submittal to USEPA.

Analytical data collected in accordance with this OMMP will be validated using the SOP Data Validation (Appendix E of Alcoa 2005) in the Quality Assurance Project Plan[4] and reported to USEPA each time a monitoring event is conducted (every other year starting in 2019). Cumulative analytical results will be presented graphically and in summary tables in the annual Remedial Action Annual Effectiveness Report to provide data necessary for trend analyses and overall program evaluation.

2 MARSH

The RAO for marsh sediment monitoring has been met[5] for all Closed Area marsh locations, and monitoring of these locations is no longer required. In addition, many of the marsh grass areas have been removed via excavation or herbicide application, as approved by USEPA. Alcoa will continue to apply herbicide (SOP-BESI-901 in Appendix A2 to the main report) to prevent marsh grasses from reestablishing (Figure 2-2 in the main report) on a periodic basis. During the growing season (March through November), Alcoa will evaluate marsh grass conditions once per month and spot treat emergent vegetation. USEPA will be notified of any modifications to the scope or frequency of this monitoring/application program.

[4] Alcoa, 2005. *Quality Assurance Project Plan*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. August 22, 2005.
[5] The final marsh achieved the RAO in fall 2015 (Alcoa, 2016. *2015 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 31, 2016). Other marshes had achieved the RAO in previous years.

Lavaca Bay Sediment Remediation and Long-Term Monitoring Plan

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

September 2003

ALCOA

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1.0 INTRODUCTION

The proposed remedial action plan for the Alcoa/Lavaca Bay Superfund site focuses on eliminating on-going sources of mercury to the Bay, reducing surface sediment mercury and polyaromatic hydrocarbon (PAH) concentrations, and ultimately reducing fish tissue mercury concentrations. A key factor in the success of the proposed Lavaca Bay Remedy is the reduction in sediment mercury concentrations through targeted sediment removal efforts, capping, enhanced natural recovery, and/or natural recovery. Sediment and/or water quality monitoring will occur during these remediation activities, and sediment monitoring will also occur on a long-term basis as a mechanism to verify that the source control and remedial measures have been effective in reducing sediment concentrations to acceptable levels. The monitoring efforts for both the remaining remedial activities, as well as the long-term verification are presented in this Operations, Maintenance and Monitoring Plan (OMMP).

1.1 PURPOSE AND SCOPE

Much of the bay sediment remedy has already been implemented (e.g., on-going source control/elimination, CAPA sediment hot spot removal, dredging of the Witco Channel, and elimination of the biological uptake areas associated with the perimeter marshes around the north end of Dredge Island). However, two areas of the bay will be remediated as part of implementing the Record of Decision (ROD, EPA, 2001). These areas include enhanced natural recovery (thin layer cap) in the area north of Dredge Island (Alcoa, 2002a) and Witco Marsh remediation (Alcoa, 2002b) as shown in Figure 1. To monitor the effectiveness of the sediment remedy, this OMMP has been developed for monitoring during sediment remediation activities as well as long-term post-remediation monitoring to determine reductions in sediment mercury concentrations over time.

1.2 SITE DESCRIPTION

The Alcoa/Point Comfort Operations (PCO) Plant is located in Calhoun County, Texas, adjacent to Lavaca Bay (Figure 1). The site is defined in the Administrative Order on Consent (AOC) and in the Project Management Plan (Alcoa, 1996b). While these documents describe all of Lavaca

Bay as being part of the site, the monitoring described in this OMMP is restricted to the Closed Area of the bay. Monitoring is limited to the Closed Area because that is the only part of the bay with concentrations in excess of the sediment cleanup targets identified in the ROD.

1.3 LONG-TERM POST REMEDIATION MONITORING

The post-remediation, long-term monitoring focuses on monitoring sediment mercury concentrations from open water and marsh areas within the Closed Area (as defined by Texas Department of Health's boundaries) and comparing them to the habitat-specific remediation goals developed for the Remedial Action Objectives (RAOs) described in the Feasibility Study (Alcoa, 2001). Previous investigations (e.g., Mercury Reconnaissance Study [Alcoa 1996a] and Prey Item Study [Alcoa, 1998]) indicated that marshes and mudflat areas varied dramatically from open water areas not only in their biological importance to the Lavaca Bay food chain, but also in mercury methylation rates and biota uptake. Marshes were found to contain the highest density of aquatic biota in the Bay and consistently showed the highest concentrations and overall rates of mercury methylation. As such, different remediation goals were developed for sediments in marsh areas compared to open water areas of the bay. The sediment cleanup goal identified in the Feasibility Study was 0.5 mg/kg mercury for open water sediments and 0.25 mg/kg for sediments in nearshore marsh habitats. These concentration values are also identified in the ROD as the target cleanup levels for sediment. Since one of the components of the sediment remedy is natural recovery, long-term monitoring is necessary to verify that recovery is occurring in an acceptable manner.

2.0 PERFORMANCE OBJECTIVES AND STANDARDS

Two types of monitoring are described in this section of the OMMP. The first section describes the monitoring that will occur immediately following implementation of the two remaining remedial measures. The second section describes the long-term monitoring that will occur annually until remedy effectiveness has been demonstrated.

2.1 REMEDIATION MONITORING

The performance objective and subsequent compliance monitoring standards that will be applied during remediation are geared towards verifying the effectiveness of each remedial measure. Since the remedial measures vary in terms of remedial technique used, the compliance standards vary accordingly. Sediments that are not actively remediated should recover to acceptable levels based on the natural sedimentation processes in the bay. Based on analyses that are presented in the Feasibility Study, the estimated timeframe to recovery is 5 to 10 years.

2.1.1 Enhanced Natural Recovery-North Dredge Island

This remedial measure involves placing a thin-layer cap over a 60 to 90 acre area north of Dredge Island (Alcoa 2002a). The monitoring during remediation will be confirmatory bathymetric survey readings taken before, during and after capping to ensure that 6 to 12 inches of cap material is placed over the target area. Post-capping surface sediment monitoring will evaluate surface concentrations to verify they are sufficiently low (less than 0.5 mg/kg) to protect biota exposure to contaminated sediments. This surface sediment sampling will also evaluate the potential that the cap material could become entrained with the underlying sediments, thus causing the final surface concentration to be higher than the cap material by itself.

2.1.2 Witco Marsh

The Witco Marsh remediation is intended to eliminate the increased biological uptake of mercury potential in marsh environments through the elimination of the marsh (Alcoa 2002b). Marsh removal and adjacent contaminated sediment remediation will be accomplished by dredging to depths below known contamination. Compliance monitoring will incorporate a marsh habitat survey to verify the marsh has been entirely removed, and a bathymetry/elevation survey to verify that final water depths were achieved such that the prism of contaminated sediment is removed and a clean sediment surface will exist that will not be conducive to marsh recolonization (due to water column depth).

2.2 LONG-TERM POST REMEDIATION MONITORING

The long-term monitoring encompasses extensive surface sediment sampling throughout the Closed Area of Lavaca Bay (described in more detail in subsequent sections of this OMMP). The overall performance standard that should be met by this monitoring plan relies on comparing the mean for open water and marsh habitat total mercury sediment concentrations to the remediation goals developed for those respective habitats in the RAOs developed for the Feasibility Study (Alcoa 2001).

2.2.1 Open Water Sediment Monitoring

Open water areas included in the long-term monitoring component are based on the results of previous field investigations compared to an open water sediment remediation goal of 0.5 mg/kg for total mercury in sediments. Since all surface sediment concentrations outside the Closed Area are currently below 0.5 mg/kg, the long-term sediment monitoring component is limited to the Closed Area. Including samples from outside the Closed Area would bias the average to the low side. Also, since concentrations outside the Closed Area are below the remediation goal, no further remedial action or monitoring is warranted for that area.

2.2.2 Marsh Sediment Monitoring

The Lavaca Bay ROD includes a sediment remediation goal of 0.25 mg/kg for marsh/mudflat areas of the Closed Area, which is lower than that for open water due to the increased potential for mercury methylation and biological uptake associated with marshes. The sampling methods discussed in further detail in Section 3.2.2 account for the number and size of marshes present in the Closed Area.

3.0 SAMPLING APPROACH

Surface sediment sampling methods for chemical analysis will follow previously approved protocols identified in the Remedial Investigation report (Alcoa 1995), and subsequent detailed investigations. Field personnel will follow health and safety procedures and laboratory coordination/data review procedures also provided and approved by the Agency in these reports.

3.1 REMEDIATION MONITORING

The timing of the remediation monitoring is linked to implementing the actual remedial measure. The remedial design reports (RDRs) for the two remaining remedial measures discuss the timeframe within which the remedial measures are likely to be implemented.

3.1.1 Enhanced Natural Recovery – North End of Dredge Island

As described in the Remediation Design Report for this remedial action (Alcoa 2002a) the cap material discharge diffuser will be constantly moved throughout the target area to provide a uniform 6- to 12-inch thin layer cap. Confirmation of bathymetry and sediment sampling (for physical evaluation only) will be done periodically during construction to verify adequate cap thickness has been obtained. Also, randomly located surface grabs will be collected and analyzed for sediment chemistry after cap placement to verify final concentrations are below the target 0.5 mg/kg remediation goal. Samples will be collected at a density of one sample per 3 acres capped, for a total of 20 to 30 samples. If the conformational monitoring indicates 0.5 mg/kg is being exceeded, then additional cap material will be placed.

3.1.2 Witco Marsh

Previous sampling has adequately characterized the depth (thickness) of sediments contaminated with mercury and PAHs. Therefore, no additional sediment chemistry characterization is required. Post-dredge chemistry sampling is not necessary because the depth of removal, which is driven by equipment requirements, substantially exceeds the depth of contamination. A bathymetric survey will be conducted to verify that the targeted depth was achieved and that marsh habitat will not re-colonize.

3.2 LONG-TERM POST REMEDIATION MONITORING

There are two separate long-term evaluation endpoints, the open water sediment concentrations and the marsh sediment concentrations. The sampling approaches for these two endpoints are described below. Monitoring for both endpoints will occur annually, and will be conducted in November, the end of the hurricane season, to ensure that storm effects are taken into consideration in the surface sediment concentration.

3.2.1 Open Water Sediment Sampling Approach

Evaluation of open water sediment mercury concentrations within the Closed Area will be determined by collecting samples on a grid-based design using a similar approach and level of detail as used in the Remedial Investigation (RI) to delineate the cleanup area. This approach divides the Closed Area into a 250-square meter grid, (see Figure 2) yielding a total of approximately 90 sampling grids. Within each grid, or substation, the average mercury concentration will be determined through field sampling.

One randomly placed sample will be collected to determine the value for that grid location. Where possible, the sample locations from 2A will be reoccupied as opposed to randomly placed. Half and partial grid boxes along the outside perimeter of the Closed Area (i.e., area SW of Dredge Island) will be sampled similar to fill grid boxes, i.e. one randomly sampled location. Partial boxes bordering the marsh areas will not be sampled. Instead, the marsh specific monitoring program specified below will be relied on to monitor recovery in these areas.

Once all grid location concentrations have been determined, the mean will be calculated for the entire open water portion of the Closed Area and compared against the ROA-based remediation goal of 0.5 mg/kg. A final value that is below the RAO-based goal (i.e., 0.5 mg/kg) will indicate compliance with the objectives of the ROD. Specific locations that exceed the 0.5 mg/kg threshold may continue to be monitored or re-evaluated in subsequent years to determine the recovery of more localized areas. However, for purposes of complying with the ROD, an area average will be used as the measure of comparison to the 0.5 mg/kg target. An average open water mercury concentration greater than 0.5 mg/kg will indicate non-compliance with the objectives of the ROD and the entire Closed Area will continue to be monitored. The length of time for long-term monitoring is further discussed in Section 3.2.3.

3.2.2 Marsh Sediment Sampling Approach

The sampling approach for determining compliance of marsh sediments with the RAO-based remediation goal is based on an approach where all marshes contained within the Closed Area are assigned a weighted value based on their respective percentage of the total marsh area present. These weighted values are then used to determine a total average value for all marsh habitat with in the closed area. This approach is based on the assumption that the larger, more productive marshes should have a greater impact on the final Closed Area marsh average than a smaller, less productive marsh. Figure 3 summarizes the approximate locations of the present day marshes within the Closed Area with an estimate of their respective percent of the total marsh habitat available within the Closed Area. The locations and exact size of each marsh within the Closed Area will be verified through field surveys and, if needed, aerial photography prior to implementation. To ensure that each marsh is adequately subsampled, a minimum of three samples will be collected from each marsh, and additional samples will be collected from larger marshes.

Marsh sample locations will be established at the fringe of vegetation during the first monitoring event. These locations will be revisited in subsequent years, even if the vegetative boundary has shifted. For marshes that comprise 10% or less of the total marsh habitat, 3 discrete samples will be collected and composited into one sample for lab analysis. Four discrete samples will be collected and composited into one lab sample for marshes that are 10 to 15% of the total habitat. Five discrete samples will be collected at marshes that are greater than 15% of the total marsh habitat.

Once all samples have been collected, an average sediment mercury concentration will be calculated for each marsh within the Closed Area, and will be compared to the remediation goal of 0.25 mg/kg. If the mean is less than the remediation goal, the objectives of the ROD will have been met. However, some individual marshes may exceed the target, and if they do they will continue to be monitored or re-evaluated in subsequent years to determine when they have recovered to an acceptable level. The length of time for long-term monitoring is further discussed in Section 3.2.3.

3.2.3 Long-Term Monitoring Duration

Long-term compliance monitoring to verify compliance with the open-water and marsh habitat sediment remediation goals of 0.5 and 0.25 mg/kg respectively will begin following issuance of the consent decree. Compliance monitoring will occur annually until two consecutive events are less than the target remediation goals. Once this is achieved for two consecutive events, long-term monitoring will be complete. If either the open water or the marsh sediments attain the two consecutive events below the goal, monitoring of that endpoint will be complete, even if monitoring of the other endpoint continues.

4.0 REFERENCES

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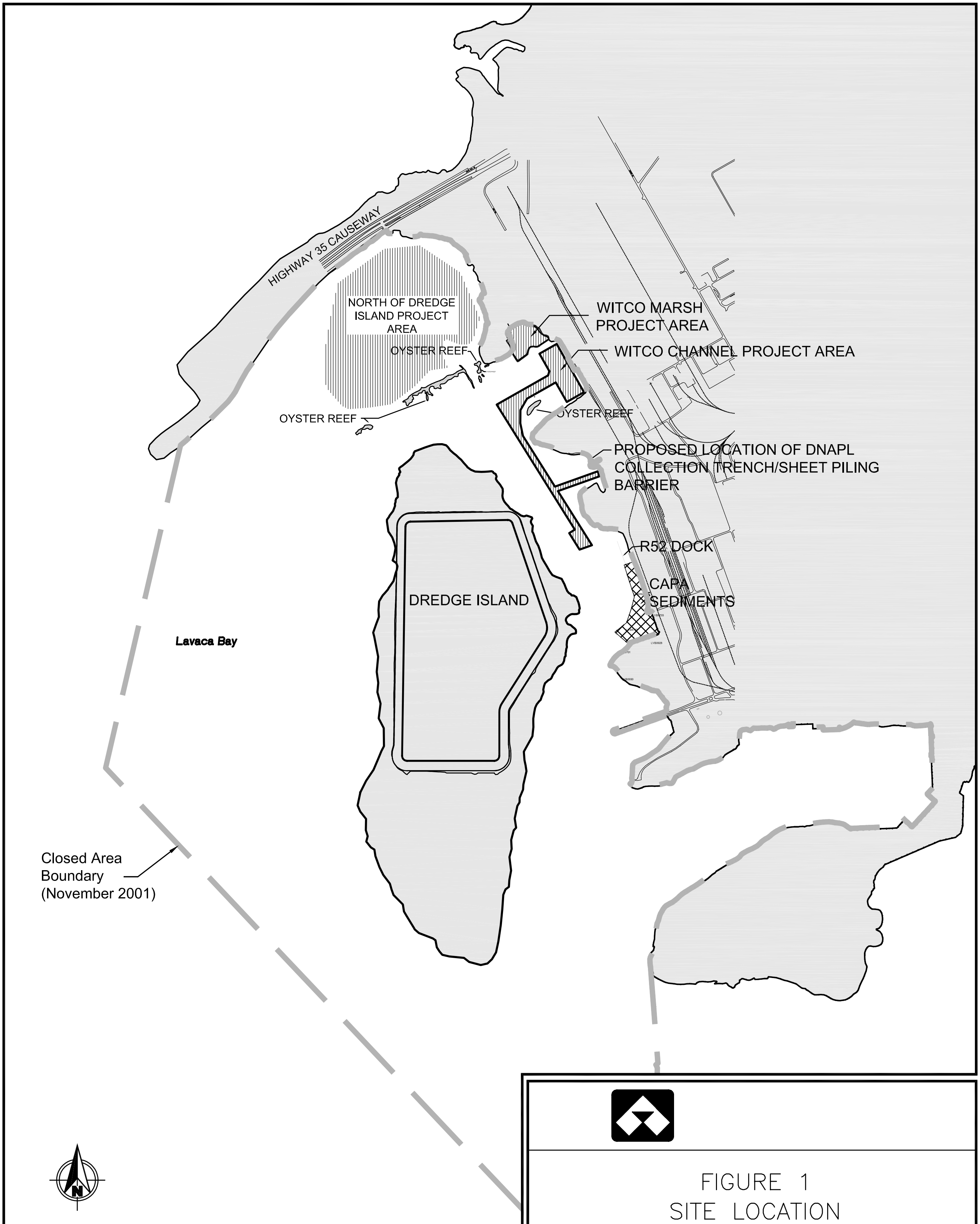
———, 2001. Draft Feasibility Study Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Revision F-3, dated January 9, 2001.

———, 2002a. Draft Remedial Design Report, North of Dredge Island Enhanced Natural Recovery, Alcoa (Point Comfort)/Lavaca Bay Superfund Site, dated January 2002.

———, 2002b. Draft Remedial Design Report, North of Dredge Island Witco Marsh Fill, Alcoa (Point Comfort)/Lavaca Bay Superfund Site, dated January 2002.

EPA, 2001. Record of Decision Alcoa (Point Comfort)/ Lavaca Bay Site, Point Comfort Texas, CERCLIS #TXD 008123168, United States Environmental Protection Agency Region 6 Superfund Division, December 2001.

FIGURES



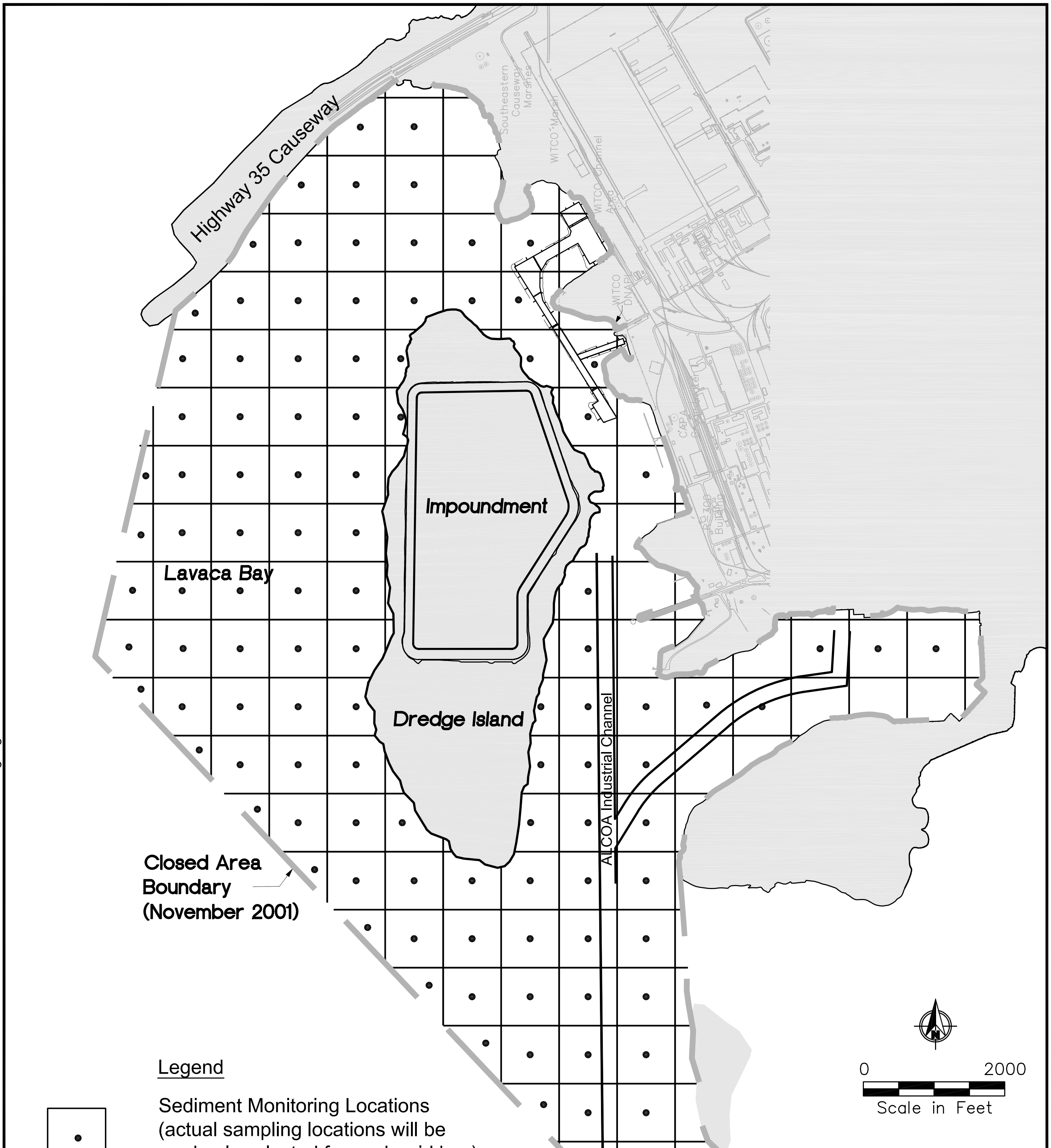
0 2000
Scale in Feet

4/11/02 ALC-02000202-03.dwg RC

FIGURE 1
SITE LOCATION

PROJECT: 02-0002-02	DATE: APRIL 2002
REV:	BY: RC CHECKED: TS

ALCOA
Point Comfort Operations



Legend

Sediment Monitoring Locations (actual sampling locations will be randomly selected for each grid box) Grid Spacing = 250m x 250m

Alcoa Industrial Channel - deep water habitat will be subtracted out of the calculation

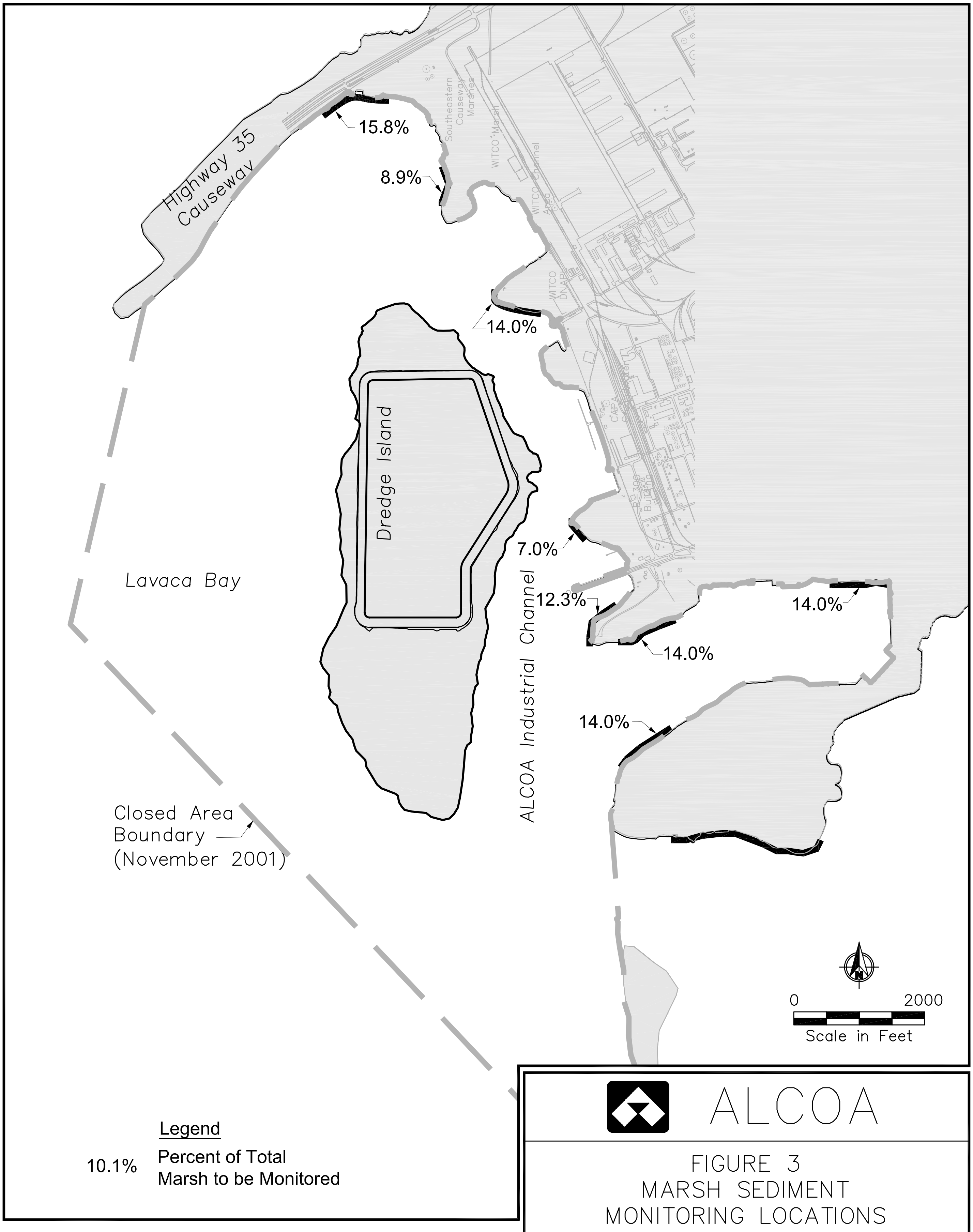
ALCOA

FIGURE 2
OPEN WATER SEDIMENT
MONITORING GRID

PROJECT: 02-0002-02	DATE: JULY 2003	
REV:	BY: CD	CHECKED: TS

ALCOA
Point Comfort Operations

Jul 08, 2003 2:01pm cdavidson I:\CAD\Jobs\020002-Alcoa\02000202\02000202-10.dwg Fig 2



ALCOA

FIGURE 3
MARSH SEDIMENT
MONITORING LOCATIONS

PROJECT: 02–0002–02	DATE: JULY 2003	
REV:	BY: RC	CHECKED: TS

ALCOA
Point Comfort Operations

Jul 09, 2003 8:02am rchao I:\CAD\Jobs\020002-Alcoa\02000202\ALC-02000202-10.dwg Fig 3 Monitoring Locations

UPDATE TO LAVACA BAY SEDIMENT SAMPLING STANDARD OPERATING PROCEDURES

Appendix A2 to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019, contains the following standard operating procedures (SOPs) for sediment monitoring:

- SOP-BESI-105: Collecting Sediment Samples with a Pole Mounted Ekman Grab Sampler
- SOP-BESI-125: Processing Sediment Samples with a 60 mL Disposable Syringe
- SOP-BESI-501: Sample Labeling and Chain-of-Custody Requirements
- SOP-BESI-901: Herbicide Application Using a Backpack Sprayer for Controlling *Spartina alterniflora*

STANDARD OPERATING PROCEDURE
SOP-BESI-105

TITLE: Collecting Sediment Samples with a Pole Mounted Ekman Grab Sampler

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/07/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Matthew Jay		11/07/18

Revision No. ____2_____

COLLECTING SEDIMENT SAMPLES WITH A POLE-MOUNTED EKMAN GRAB SAMPLER

1.0 PURPOSE AND APPLICABILITY

This SOP describes the proper procedures for operating a pole-mounted Ekman grab sampler to collect surficial sediment (0-6 inches deep), and handling sediment samples after collection. The purpose is to obtain surficial sediment samples for chemical analysis.

2.0 DEFINITIONS

Surficial sediment – Material from the top layers of sediment. Sediment from the 0-6 inch layer are generally considered surficial. The depth to be sampled must be specified.

3.0 HEALTH AND SAFETY CONSIDERATIONS

3.1 Nitrile gloves and approved safety glasses should be worn when conducting this procedure to reduce exposure to contaminants that may be present in the water or sediment.

3.2 If volatile chemicals are expected in samples, respirators (with proper cartridge) must be worn.

3.3 Proper lifting techniques should be utilized when handling heavy objects.

3.4 Sampling and vessel operation personnel will adhere to the project health and safety plan at all times. General boat safety criteria should be practiced at all times, including awareness of other ship activities, wearing life jackets, monitoring marine radio, etc.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP will be implemented by personnel trained to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is conducted.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure and provide all the necessary information and data sheets to conduct the study. The task manager has responsibility for assuring that:

- All necessary equipment is available
- Health and safety precautions are taken
- Enough information has been provided to locate sample area and stations.

6.0 EQUIPMENT AND MATERIALS

- Pole Mounted Ekman grab sampler
- PVC Messenger
- Tub (to receive filled sampler)
- Stainless steel bowl
- Stainless steel or Teflon® spoons
- Sample jars
- Ruler

7.0 TRAINING

Prior to conducting this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 A pole-mounted Ekman grab will be used to collect surficial sediments. An Ekman grab sampler has an open or screened top to allow water to pass through the sampler as it descends, reducing forward wake, which can disturb surface sediment. The grab sampler is attached to an aluminum pole and has a PVC pipe to trigger the sample jaws.

8.2 The sampler is decontaminated according to specifications of the sampling and analysis plan, and the clean sampler is placed in a clean tub or on another clean surface on the deck of the boat. Following vessel positioning and position stabilization, the sampler is deployed over the side of the vessel by a trained person (Section 4.0). To prevent forward wake, the sampler should not descend faster than approximately 0.2 m/sec as it nears the bottom.

8.3 Once the sampler has reached the sediment surface, the operator will slowly insert the sampler into the sediment to the desired sample depth. A PVC trigger is used to shut the jaws of the sampler.

8.4 Retrieval of the sampler, after the jaws have been triggered, must be slow to ensure proper closure of the jaws. The sampler should be retrieved at a speed of approximately 0.3 m/sec to prevent disturbance of the sample. The sampler should be lifted slowly from the water and quickly secured within the clean tub. Rapid retrieval or swinging may disturb the sample of surface sediments. The retrieved sampler will be lowered into a clean tub or tray, and secured in an upright position to prevent sediment sloshing.

8.5 A sample is acceptable if it is covered with water and/or the surface sediment is relatively flat and undisturbed. Because of the action of the closing jaws, some samples may be flat and undisturbed only in the center. If a sample is not acceptable it should be set aside (do not dump overboard), the sampler rinsed with site water, and a second sample should be collected. Unacceptable samples can be discharged overboard (or if required by the sample plan, disposed of in a drum or bucket for offsite disposal) after an acceptable sample is collected.

8.6 Sample depth within the sampler is measured using a pre-cleaned stainless steel ruler around the edges of the sample, prior to removal of the sample from the sampler. Samples may be considered unsuitable if there is less than the required sediment depth collected for the study in the sampler. If necessary, the sample station may be relocated slightly and the change documented in the sample log. Alterations to sampling locations will be made in consultation with the client.

8.7 If measurements are to be taken from water overlying the sediment sample, they must be taken before the sample is disturbed or overlying water must be collected for the measurements. Each sample will be photographed within the Ekman (with a board or paper showing the sample ID) prior to disturbance of the material during removal to the stainless steel bowl.

8.8 Prior to removing sediments from the sampler, the overlying water will be siphoned off with a piece of tubing or a turkey baster, or the grab sampler will be drained by gently tilting it.

8.9 Sediment for chemical and biological analyses may be removed using pre-cleaned stainless steel spoons and composited in a pre-cleaned stainless steel bowl with pre-cleaned stainless steel spoon. Only the sediment from the center of the grab sampler (i.e., no sediment touching the walls of the sampler) will be used. If sub-samples are needed, they will be collected from the homogenized sample only, using a spoon, scoop, or core tube. Alternate methods may be used depending on individual sampling and analysis plans.

8.9 The empty sampler will be decontaminated by scrubbing with site water and Alconox® or an equivalent cleaning chemical, and rinsed with deionized water. The sampler and associated equipment are decontaminated before use and between sample locations. Equipment used for sample collection, sub-sampling, and sample mixing (i.e., spoons, knives, scoops) will be stainless steel or Teflon®.

9.0 QUALITY CONTROL CHECKS

Clean nitrile gloves will be worn at all times when handling the sampling equipment in order to reduce the chance of contaminating the sediment sample. Nitrile gloves will be replaced by sampling personnel between samples.

10.0 DOCUMENTATION

A field log book will be used to document the date and time of sample collection, the water depth at the location of the sample, sediment depth within the sampler prior to removal, basic sediment characteristics, station coordinates, sample time and processing time.

General descriptive information on the sediments and appropriate field data should be entered in the field data log. Observations may include some or all of the following:

- Characteristics of sample, including texture, color, biological structures (e.g., shells, benthic infauna), debris (wood chips, human artifacts), odors (oil, gas, hydrogen sulfide),
- Approximate depth or aerobic and anaerobic sediment layers,
- Penetration depth of the sampler and/or general depth of sample taken (i.e., top 2 cm, 2-10 cm, etc.), and,
- Comments that relate to sample quality such as leakage, winnowing, disturbance.

NOTE:

FOLLOW ONLY THE MOST RECENT ISSUE OF THIS SOP.

STANDARD OPERATING PROCEDURE
SOP-BESI-125

TITLE: Processing Sediment Samples with a 60 ml Disposable Syringe

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/07/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Matthew Jay		11/07/18

Revision No. ____1_____

COLLECTING SEDIMENT SAMPLES WITH A POLE-MOUNTED EKMAN GRAB SAMPLER

1.0 PURPOSE AND APPLICABILITY

This SOP describes the proper procedures for processing unconsolidated surficial sediment samples using a 60ml syringe. The purpose is to obtain surficial sediment samples for chemical analysis.

2.0 DEFINITIONS

Surficial sediment – Material from the top layers of sediment.

3.0 HEALTH AND SAFETY CONSIDERATIONS

3.1 Nitrile gloves and approved safety glasses should be worn when conducting this procedure to reduce exposure to contaminants that may be present in the water or sediment.

3.2 If volatile chemicals are expected in samples, respirators (with proper cartridge) must be worn.

3.3 Proper lifting techniques should be utilized when handling heavy objects.

3.4 Sampling and vessel operation personnel will adhere to the project health and safety plan at all times. General boat safety criteria should be practiced at all times, including awareness of other ship activities, wearing life jackets, monitoring marine radio, etc.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP will be implemented by personnel trained to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is conducted.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure and provide all the necessary information and data sheets to conduct the study. The task manager has responsibility for assuring that:

- All necessary equipment is available
- Health and safety precautions are taken
- Enough information has been provided to locate sample area and stations.

6.0 EQUIPMENT AND MATERIALS

- Grab sampler (e.g. Van Veen, Ekman, ponar)
- 60 ml syringes (sterile and individually packed)
- Tub (to receive filled sampler)
- Marking pens
- PVC cutter
- Sample jars
- Ruler
- Freezer grade resealable plastic bags
- Sample cooler and ice
- Alconox
- Distilled water
- Scrub brush

7.0 TRAINING

Prior to conducting this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Sediment samples will be collected using a grab sampler. Sediment samples will be processed as soon as possible after sample collection.

8.2 Prior to processing a sediment sample, the depth of sediment to sample will be determined (e.g. 2cm, 3cm, 4cm, etc.) and the syringe will be modified as listed below.

8.2.1 Remove the syringe from the package.

8.2.2 Using a PVC cutter, remove the lower end of the syringe barrel (needle lock) to transform the syringe barrel into an open cylinder.

8.2.3 Using a ruler and marking pen, measure from the bottom of the modified syringe up to the sample depth for the project

8.3 Place the open end of the syringe barrel on the surface of the sediment.

8.4 While holding the syringe piston stationary, push the barrel down to the marked sample depth

8.5 Remove the syringe from the sediment and place the end of the syringe over the top of an open sample jar and push the syringe piston and remove the sediment from the syringe into the sample jar.

8.6 Repeat steps 8.3 through 8.5 until the volume of sediment required for the study is processed.

8.7 Seal the lid on the sample jar and shake the jar to homogenize the sample.

8.8 Dispose of the syringe into an appropriate trash bag, bucket, or barrel.

8.9 Place the lid on the sample jar and seal it in a resealable freezer bag and store the sample in an insulated cooler with ice.

8.9 Empty the grab sampler and decontaminate with a brush, site water and Alconox® or an equivalent cleaning chemical, and rinsed with distilled water. The sampler and associated equipment are decontaminated before use and between sample locations.

9.0 QUALITY CONTROL CHECKS

Clean nitrile gloves will be worn at all times when handling the sampling equipment in order to reduce the chance of contaminating the sediment sample. Nitrile gloves will be replaced by sampling personnel between samples.

10.0 DOCUMENTATION

A field log book will be used to document the date and time of sample collection, the water depth at the location of the sample, sediment depth within the sampler prior to removal, basic sediment characteristics, station coordinates, sample time and processing time.

General descriptive information on the sediments and appropriate field data should be entered in the field data log. Observations may include some or all of the following:

- Characteristics of sample, including texture, color, biological structures (e.g., shells, benthic infauna), debris (wood chips, human artifacts), odors (oil, gas, hydrogen sulfide),
- Approximate depth or aerobic and anaerobic sediment layers,
- Penetration depth of the syringe (i.e., top 2cm, top 5cm, etc.), and,
- Comments that relate to sample quality such as large shells or disturbance.

NOTE:

FOLLOW ONLY THE MOST RECENT ISSUE OF THIS SOP.

STANDARD OPERATING PROCEDURE
SOP-BESI-501

TITLE: Sample Labeling and Chain-of-Custody Requirements

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne		11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin		11/05/18

Revision No. ___2_____

Sample Labeling and Chain-of-Custody Requirements

1.0 PURPOSE AND APPLICABILITY

To label sample containers with the correct information and effectively track the location of the samples at all times.

2.0 DEFINITIONS

There are no definitions applicable for this SOP.

3.0 HEALTH AND SAFETY CONSIDERATIONS

There are no health and safety issues applicable for this SOP.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must be also available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager is responsible for assuring that:

- All necessary equipment is available
- Proper shipping address is provided
- Proper analysis is marked on the Chain of Custody (COC)

6.0 EQUIPMENT AND MATERIALS

- Sharpies (permanent marker pen)
- Labels
- COC forms
- Pen
- Tape
- Large Ziploc®

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Sample Labeling:

8.1.1 The label will generally contain:

- Sample ID
- Sample Date
- Sample Time
- Empty sample container weight
- Sampler container number
- Initials of sampler

8.1.2 Field data logs will also be printed with the same information. Prior to use, check to ensure that the coded sample identification number on the label, and the field data logs are identical.

8.2 Chain-of-Custody Requirements:

8.2.1 An example of the chain-of-custody form is attached (Attachment A).

8.2.2 A chain-of-custody form will generally be completed for <u>each</u> sample type (matrix; e.g., water, sediment or tissue) collected or processed on a single day and it will stay with that sample type throughout shipping, storage, and analysis.

8.2.3 QA/QC samples (e.g., field blanks, duplicates, field spikes), can be entered on COC forms with the same matrix.

8.3 Completing the COC process

8.3.1 The chain-of-custody form consists of three color-coded pages: white, yellow and pink.

8.3.2 Record information on the top, white page, applying enough pressure so that the information is clearly legible on the yellow and pink carbon pages.

8.3.3 Once completed, put the chain-of-custody form in a re-sealable plastic bag, seal and store <u>with the appropriate sample(s)</u>.

8.3.4 Prior to shipping a cooler or package of samples, sign the chain-of-custody forms, and provide the date and time the samples are being relinquished for shipment.

8.3.5 Remove the pink copy of the forms and file them with the project records. Return the white and yellow copies to a plastic bag.

8.3.6 All chain-of-custody forms for samples to be shipped in a single cooler or package can be placed in a single plastic bag. The bag should be taped to the lid (inside) of the cooler/shipping package.

8.3.7 Seal the cooler/shipping package well and attach a signed chain-of-custody seal. NOTE: Generally, when the samples are received by the laboratory for analysis, the chain-of-custody forms will be signed on the "Received by" column and the yellow copy will be sent to BESI Study Director, Project Manager or designee. The white copy of the chain-of-custody form generally stays with the sample from collection through storage and analysis.

8.3.8 Staff collecting the samples should be those completing the COC forms. The field staff completing the COC form must also "relinquish" the samples.

8.3.9 If samples are held before shipping, the storage facility for the samples should be secure (locked or otherwise have limited access).

8.3.10 When the samples are removed from the holding facility, the sample integrity should be noted on the COC by the person removing the samples.

8.3.11 Personnel should then sign the "Relinquished by" column and fill out the date and time if transferring the samples to a cooler or carrier for shipment (e.g., sending in a cooler via Federal Express).

9.0 QUALITY CONTROL CHECKS

10.0 DOCUMENTATION

Attachment A **-** An example of the chain-of-custody form.

See Sample Shipping and Freezing Procedures SOP-BESI-502

USE ONLY THE MOST RECENT ISSUE OF THIS SOP

STANDARD OPERATING PROCEDURE
SOP-BESI-901

TITLE: Herbicide Application Using a Backpack Sprayer for Controlling *Spartina alterniflora*

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/12/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/12/18

Revision No. ___2______

Herbicide Application Using a Backpack Sprayer for Controlling *Spartina alterniflora*

1.0 PURPOSE AND APPLICABILITY

Herbicide application using a backpack sprayer to control new growth of *Spartina alterniflora*. This SOP describes the proper procedures for mixing, application, and storage of water, herbicide, dye, and surfactant used to control *Spartina alterniflora*.

2.0 DEFINITIONS

Three products will be used when mixing the herbicide into solution:

2.1 Roundup Custom™ – Herbicide containing glyphosate, a chemical that is toxic to growing plants and is used to kill emergent weeds, brush and vines.

2.2 Induce™ – Surfactant is a chemical that reduces the surface tension of a liquid and increases penetration, coverage and overall effectiveness of an herbicide.

2.3 Spray Indicator XL™ – Dye that is added to an herbicide mixture to serve as an application indicator. The dye will remain on vegetation that has been sprayed and can reduce over-application of the herbicide.

3.0 HEALTH AND SAFETY CONSIDERATIONS

3.1 Nitrile gloves, long sleeve shirts, and approved safety glasses will be worn when conducting this procedure to protect personnel from exposure to chemicals in the herbicide and surfactant. A change of clothes should be available in case applicator's clothes are soiled with herbicide.

3.2 Water, herbicide, dye, and surfactant should be mixed outdoors or in a well-ventilated room.

3.3 A portable eye wash kit and a general decontamination kit will be present at all times when handling, applying, and transporting herbicide and surfactant.

3.4 If a boat is used to transport employees to the application site, general boat safety criteria should be practiced at all times. Employees must be aware of ship traffic in the area, wear life jackets, and monitor marine radio, etc.

3.5 When wading in marsh grasses, employees must wear waders and rayguards.

3.6 Herbicide application should only be conducted in low wind conditions and the herbicide should always be sprayed downwind.

4.0 QUALITY ASSURANCE CONSIDERATIONS

Employees using this SOP must be trained to safely handle potentially dangerous chemicals. This SOP will not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is conducted.

5.0 RESPONSIBILITIES

The project manager will assign a task manager to conduct this procedure and provide all the necessary information and data sheets to conduct the study. The task manager is responsible for assuring that:

- All necessary equipment is available,

- Health and safety precautions are taken,
- Employees have been trained to handle chemicals and sprayers,
- Employees have read and understand the MSDS and product labels for the herbicide, surfactant, and dye listed in Section 6.0. SDS for each of the above are included in Attachment A.

6.0 EQUIPMENT AND MATERIALS

- Roundup Custom™ (herbicide)
- Induce™ (surfactant)
- Spray Indicator XL™ (dye)
- Nitrile gloves (powder free)
- Safety glasses
- Rayguards
- Waders
- Long sleeve shirt
- Backpack sprayer
- Water
- Portable eye wash kit
- Decontamination kit
- Change of clothes
- 500 beaker and/or 100 ml graduated cylinder

7.0 TRAINING

Prior to conducting this SOP, responsible personnel (task manager and technicians) must read and understand this SOP. Responsible personnel must be trained to handle potentially toxic chemicals and sprayers.

8.0 METHODS

8.1 Mixing of water, herbicide, dye, and surfactant will be conducted outdoors or in a well-ventilated room. DO NOT mix herbicide solution prior to transportation to the project site.

Place 15 liters of water in chemical tank of a backpack sprayer then add the herbicide, dye, and surfactant;

i. Herbicide (3.3%) – 495 ml
ii. Dye (0.4%) – 60 ml
iii. Surfactant (0.5%) - 75 ml

Herbicide, dye, and surfactant volumes will be measured in a 500 ml beaker or a 100 ml graduated cylinder and poured into the backpack sprayer containing water filled to the 15 liter line marked on the sprayer reservoir. The water, herbicide, dye, and surfactant will be mixed by gently shaking the backpack sprayer prior to application. If the volume of mixture required for an application is less than 15 liters, reduce the total volume using the ratios listed above. DO NOT MIX MORE HERBICIDE THAN IS NEEDED FOR EACH APPLICATION.

8.2 When possible, the herbicide mixture will be applied from the bow of a boat. In areas further away from open water, the application will be conducted on foot. When conducting the herbicide application from the boat, personnel must wear nitrile gloves, safety glasses, long sleeve shirts, and life jackets. If the application is conducted while wading, personnel must also wear waders and rayguards in addition to the PPE required for the boat application listed above.

8.3 Herbicide applications should only be conducted under low wind conditions. Apply the herbicide mixture down wind and evenly over the vegetation to be treated. The dye is used to visually track where the herbicide has been applied.

8.4 Upon completion of the herbicide application, all containers used in this procedure must be decontaminated with soap and water and triple rinsed. Also, all containers should be labeled "herbicide only"

8.5 Unused herbicide, dye, and surfactant must be stored in the original labeled sealed containers, and stored in a secure area with limited access.

8.6 Applicators should not mix herbicide solution until on the project site. Traveling with mixed herbicide solution should never occur.

9.0 QUALITY CONTROL CHECKS

Photographs will be taken of the study area immediately prior to each herbicide application and approximately 2 weeks after each herbicide event.

10.0 DOCUMENTATION

Field observations will be recorded in a project notebook and will include general descriptive information on the vegetation prior to and after the herbicide application, maps showing the areas treated with herbicide tied to dates of applications, and photographs documenting conditions prior to and after the herbicide applications. Time, date, applicator name, herbicide type, concentration of herbicide in mixed solution, location of application, area of application (acres), wind direction, ambient air temperature, and total volume of mixed solution applied should be noted. Records should be kept for a minimum of 2 years after each event.

FOLLOW ONLY THE MOST RECENT ISSUE OF THIS SOP.

UPDATE TO LAVACA BAY FINFISH AND SHELLFISH OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix B1 to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Fish and Shellfish Monitoring Operations, Maintenance, and Monitoring Plan (OMMP) from October 2003 (Alcoa 2003[1]). The monitoring program is a continuation of the previous Finfish and Blue Crab Monitoring Program and utilizes the same currently approved sampling strategy and analytical techniques.

Sampling will continue as follows:

1. The Closed Area will be divided into quadrants, with the north/south, east/west dividing lines centered over Dredge Island.
2. Sampling will be conducted annually. Samples will be collected from any of the previously established stations, although additional stations may be added depending on netting success at each station. See Figures 2-3A through 2-3D in the main report for sampling stations.
3. Red drum samples will be collected using gill nets (SOP-BESI-303 in Appendix B2 to the main report), and juvenile blue crabs will be collected using barrel traps (SOP-BESI-304 in Appendix B2 to the main report).
4. Since netting and trapping success is variable, the number of samples collected from each station may vary. The goal will be to collect 2 to 3 samples from 10 to 15 stations distributed evenly throughout the sampling area.
5. Thirty red drum samples and 30 juvenile blue crab samples will be collected from the Closed Area.
6. Thirty red drum samples and 30 juvenile blue crab samples will be collected from the Open Area adjacent to the Closed Area.
7. A juvenile blue crab sample will consist of five whole crabs between 25 and 75 millimeters total length. Total length is measured using methods listed in SOP-BESI-506 (Appendix B2 to the main report). Juvenile blue crab samples will be processed as listed in SOP-BESI-520 (Appendix B2 to the main report).
8. Red drum fish samples will be fish between 20 and 28 inches in length. Red drum samples will be measured and weighed prior to processing using SOP-BESI-508 (Appendix B2 to the main report).
9. Red drum samples will be processed as listed in SOP-BESI-509 (Appendix B2 to the main report). A sample will consist of 50 to 80 grams of tissue from the right fillet of a legal-sized red drum (either sex). A single strip will be taken from the middle of the right fillet. Strips will be

[1] Alcoa, 2003. *Lavaca Bay Finfish and Shellfish Operations, Maintenance, and Monitoring Plan*. October 2003.

approximately 2 centimeters (cm) wide and cut into 2 cm cubes before being placed into the sample container.

10. Monitoring will be conducted annually in the fall until the Remedial Action Objective for red drum has been met for two consecutive years.
11. Red drum will be shipped to the analytical laboratory to arrive the day after the fish is caught and processed. Juvenile blue crab samples will be shipped to arrive at the analytical laboratory within 7 days of collecting the first blue crab used in each composited sample. Sample shipping procedures are listed in SOP-BESI-552 (Appendix B2 to the main report).
12. The analytical method for mercury analysis on all tissue samples is U.S. Environmental Protection Agency (USEPA) Method 7473.
13. Gut content surveys (SOP-BESI-530 in Appendix B2 to the main report) will be conducted on a voluntary basis for all red drum caught and processed during the sampling event.

Issues related to the health and safety of project personnel will be addressed prior to initiation of field activities through review and revision of Health and Safety Plan addenda documents and submittal to USEPA.

Analytical data collected in accordance with this OMMP will be validated using the SOP Data Validation (Appendix E of Alcoa 2005) in the *Quality Assurance Project Plan* for the Alcoa Point Comfort/Lavaca Bay Superfund Site (Alcoa 2005[2]) and reported to USEPA after each sampling event is conducted. Cumulative analytical results will be presented graphically and in summary tables in the annual Remedial Action Annual Effectiveness Report to provide data necessary for trend analyses and overall program evaluation.

[2] Alcoa, 2005. *Quality Assurance Project Plan*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. August 22, 2005.

Lavaca Bay Finfish and Shellfish

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

October 2003

ALCOA

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LIST OF FIGURES

1.0 INTRODUCTION

The proposed remedial action plan for the Alcoa/Lavaca Bay Superfund site focuses on eliminating on-going sources of mercury to the Bay, reducing surface sediment mercury and PAH concentrations, and ultimately reducing fish tissue mercury concentrations. A key factor in the success of the proposed Lavaca Bay Remedy is the reduction in tissue mercury concentrations through targeted source control efforts, sediment removal efforts, capping, enhanced natural recovery, and/or natural recovery. Long-term tissue monitoring in red drum and juvenile blue crab will occur on annual basis following these remediation activities, and this monitoring is presented in this Operations, Maintenance and Monitoring Plan (OMMP).

1.1 Purpose and Scope

This document describes the Operations, Maintenance and Monitoring Plan (OMMP) for the finfish and shellfish monitoring program for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site. The objective of the program is to monitor the recovery of mercury levels in finfish and shellfish, and to demonstrate the effectiveness of remedial actions implemented at the site to reduce exposure levels and risk. The Record of Decision (ROD) (EPA 2002) requires monitoring of finfish and shellfish for total mercury, as described in more detail in Section 2.0. This document presents an overview of the finfish and shellfish monitoring program, the objectives of the program, the sampling and analytical methods to be used, and the methods for evaluation of monitoring data. This OMMP is one of a series of Remedial Design Reports (RDRs) and OMMPs that collectively provide the design for the entire Site remedy as defined in the ROD. These reports have been prepared as attachments to the Consent Decree.

1.2 Site Description

The Alcoa/Point Comfort Operations (PCO) Plant is located in Calhoun County, Texas, adjacent to Lavaca Bay (see Figure 1). The area covered by this OMMP is principally the “Closed Area,” although some sampling will occur outside of the Closed Area.

1.3 Existing Data

Since 1996, Alcoa has conducted four different sampling programs to evaluate and document mercury concentrations in finfish and shellfish tissue:

V*olume B12a: Finfish and Shellfish Sampling to Support Human Health Risk Assessment (1996);*

> The Finfish and Shellfish Sampling Program was conducted from the summer of 1996 through the winter of 1996 to support the human health risk assessment. The program was designed to provide comprehensive information about mercury concentrations in fish and shellfish in Lavaca Bay and background or reference bays.

Supplemental Blue Crab Sampling (1996);

> A supplemental blue crab collection program was conducted during December of 1996 to provide additional information about the spatial trends of mercury bioaccumulation in crabs inhabiting the Closed Area.

Volume B12e: Fish and Bird Prey Item Study (Summer, 1997);

> The Fish and Bird Prey Item Study was conducted during the summer of 1997 to support the ecological portion of the Lavaca Bay Baseline Risk Assessment (Alcoa 2000). Co-located sediment and tissue samples from potential fish and bird prey items were collected from three habitats (intertidal fringe marsh/mudflat, oyster reef, and open water) identified as important foraging areas for carnivorous fish and birds. The objectives of the study were to determine mercury concentrations in selected prey organisms for use in computing doses to carnivorous fish and birds in the BLRA, to determine if mercury concentrations in prey item tissues trend with mercury levels in co-located sediments on a local (habitat) and geographic (bay “zones”) basis; and to evaluate and quantify the nature of any predictive relationships between mercury concentrations in sediments to that in tissue to support remedial activities at the site.

Volume B12b: Finfish and Blue Crab Monitoring Study (1997- 2001);

> The Finfish and Blue Crab Monitoring Study was initiated in the summer of 1997 and has continued through the fall of 2001. The study was designed as a follow-up study for the Finfish and Shellfish Sampling Program, to evaluate the temporal and spatial trends of mercury bioaccumulation in the edible tissues of red drum, black drum, and blue crabs. Finfish and crabs were collected from within the Closed Area and from reference sites outside the closed area.

The most comprehensive data for evaluating spatial and temporal trends in mercury concentrations is associated with the Finfish and Shellfish Monitoring Program. This program was initially designed to monitor trends in mercury concentrations in fish and shellfish consumed by humans (i.e., red drum, black drum, and adult blue crabs). However, the program was expanded in 1998 to include Gulf killifish, a prey species that is known to be involved in a food web associated with mercury bioaccumulation; and spotted seatrout, a recreationally important game fish and food fish in Lavaca Bay (B12a Work Plan Refinement Notice 05, 1998).

2.0 MONITORING OBJECTIVES AND STANDARDS

The purpose of this OMMP is to establish a program that will monitor the effectiveness of the combined remedial actions for Lavaca Bay. Decreasing trends in mean mercury concentrations in finfish and shellfish tissue would indicate that remedial activities targeted at sources and sediments are having an effect in reducing mercury exposure levels.

2.1 Record of Decision Requirements

The ROD for the Site describes the remedial action objectives as follows:

> *"[Remedial Action Objectives ("RAOs")] for Lavaca Bay are to (1) eliminate or reduce to the maximum extent practical mercury loading from on-going unpermitted sources to Lavaca Bay; (2) reduce to an appropriate level mercury in surface sediments in sensitive habitats; and (3) reduce to an appropriate level mercury in surface sediments in open-water that represent a pathway by which mercury may be introduced into the food chain. The objectives are designed to allow the reduction of mercury levels in fish tissue such that the overall risk throughout Lavaca Bay will approach that which would be present but for the historic Point Comfort Operations." (p. 8-1)*

The first RAO, mercury loading from unpermitted sources, has been addressed by the Dredge Island stabilization project and groundwater controls at CAPA. The second and third RAOs are addressed by the Dredge Island stabilization project, dredging treatability studies, monitored natural recovery, and enhanced natural recovery.

Therefore, the purpose of the Lavaca Bay Finfish and Shellfish OMMP is to collect and evaluate data to document that the RAOs have been met, and mercury levels in fish tissue have been reduced such that the overall risk throughout Lavaca Bay approaches that which would be present but for the historic Point Comfort Operations.

As summarized in the ROD (p. 8-1), the BLRA assessed risk to four different exposure groups. The risk to "All Fishermen" was similar to "Lavaca Bay Fishermen". The risk to "Lavaca Bay and Closed Area Fishermen" was similar to "Closed Area Fishermen", and approximately twice as high as the first two groups of fishermen. All exposure factors and other elements of the risk assessment for the four groups of fishermen were identical, except for the concentration of mercury in fish being consumed. Therefore the concentration of mercury in fish tissue can be used as a surrogate for repeating the risk assessment after each year of monitoring to assess the effectiveness of the remedy. If the concentration of mercury in fish from the Closed Area approaches that from the Open Area in Lavaca Bay, then the risk from consumption of fish would be similar for the four groups of fishermen, and the goal of the remedy will have been met - mercury levels in fish tissue will have been reduced such that the overall risk throughout Lavaca Bay approaches that which would be present but for the historic Point Comfort Operations. Comparison of the red drum tissue samples can therefore be used to evaluate the performance of the selected remedy.

The ROD's Summary of Alternatives states:

> *"Generally, the monitoring program will discuss anticipated ranges and timeframes for decreases in mercury-tissue levels in fish and shellfish and mercury concentrations in surface sediments. For fish and shellfish, shorter-term quantitative goals will be developed during remedial design to help measure progress toward the ultimate remedial objectives. The shorter-term quantitative goals will describe a range of concentration levels in fish and shellfish and time intervals over which recovery should occur, taking into account variability and uncertainty in parameters that could affect recovery rates. Trend analysis will be utilized to evaluate the reductions in mercury in fish and shell fish over time. If the anticipated reductions of mercury in fish/shellfish and/or sediments are not achieved within the anticipated timeframe, an evaluation of the remedy effectiveness will be undertaken." (pp. 9-4 and 9-5)*

Therefore, the OMMP must address the evaluation of temporal trends in tissue concentrations, and under what circumstances an evaluation of the remedy effectiveness will occur.

2.2 Remediation Performance Standards

The monitoring approach in this OMMP has two purposes: 1) determine what the short-term trends are in juvenile blue crab as a relatively immediate measure of remedy effectiveness; and 2) determine whether or not mercury tissue levels in the general vicinity of the Closed Area have reached acceptable levels. The short-term trends in juvenile blue crab will be used as a "qualitative" means of evaluating the remedy effectiveness, but will not be used as a quantitative measure. Blue crab mercury concentrations will not be the basis for final determination of remedy success; red drum will be used for that purpose, as described in further detail below. Juvenile blue crab were selected for this purpose because they should demonstrate a more rapid response time due to their niche in the food chain being a lower trophic level, bottom-dwelling, and sediment based feeding organism. Juvenile blue crab concentrations will be evaluated for trends in the first few years of monitoring. Juvenile crabs between 25-75mm will be collected, and one laboratory sample will be defined as the whole body composite samples consisting of 5 juvenile crabs.

The direction of the juvenile blue crab concentration trends (increasing versus decreasing) and the magnitude of the trend (how fast are concentrations increasing or decreasing) will be used in a preliminary assessment of remedy effectiveness. An increasing trend would indicate that the sediment remedies are not being effective at reducing tissue concentrations, and would warrant consideration of additional remedial measures. A decreasing trend would indicate that the sediment remedies are having the desired initial effect, and would warrant further examination of the red drum data to determine when the reduction has reached an acceptable level. A static or fluctuating trend would indicate that multiple parameters are affecting tissue concentration, and that further monitoring will be necessary, but that additional remedial measures may also be necessary.

A human health risk assessment, such as was conducted in the Baseline Risk Assessment (Alcoa 2000), typically takes into account a fish consumption diet that is comprised of several different species, and allocates a percentage of each species to the total diet. This type of an approach takes into account that some species may have higher mercury concentrations than others, by allocating the appropriate percentage of each species into the total diet. The allocation is often determined through a site-specific angler survey that provides detailed information on which species are consumed, and the percentage of their diet they comprise. This approach was useful in evaluating baseline risks, but can complicate a long-term monitoring program in that it requires the collection of several different species, and potentially collecting additional angler survey information.

This OMMP has simplified the long-term monitoring approach by focusing on a single species that is appropriately conservative, and selecting a target performance standard concentration that will be protective of human health. Red drum tissue concentrations, on average, in the general vicinity of the Closed Area need to be in the range of 0.3 to 0.7 ppm total mercury for the remedy to be declared effective in protecting human health. The upper end of this range is tied to the uncertainty around the reference dose (see the Baseline Risk Assessment, Alcoa

2000 for further discussion on reference dose). It is possible (and likely) that some individual fish within the total sample size will exceed the high end of the range (0.7 ppm), but on average the concentration must be equal to or less than 0.7 ppm for the remedy to be declared successful. Adult red drum, within the legal slot limit as defined by Texas Parks and Wildlife, will be sampled because they represent the fish that can be legally retained and consumed. Red drum that are below or above the slot limit will not be retained for analyses. The specifics of the sampling stations and number of samples that will be used in the calculation of this average tissue concentration are provided in the following section on Sampling Approach.

The general vicinity of the Closed Area was selected as the appropriate geographic range for the sampling stations. Limiting the sampling to just the Closed Area does not account for the practical aspect of angler trips which are influenced by launch locations and "fishing holes" in proximity to that launch location rather than by boundary lines on a map. The locations for fish sampling are described in more detail in Section 3.0.

3.0 TECHNICAL APPROACH

3.1 Development of Sampling Approach

The technical approach for evaluating whether the tissue-related RAOs are met consists of two parts, remedy effectiveness analysis and temporal trend analysis. Remedy performance will be evaluated by statistically comparing red drum mercury tissue samples collected from the Open and Closed Areas. Tissue samples will be collected annually during the fall. Since historical data indicate the tissue concentrations from the Closed Area have statistically higher concentrations than tissue samples from the Open Area, when the samples collected from the two areas are statistically equivalent, then the remedy for Lavaca Bay will be considered effective and complete. Trend analysis of blue crab and red drum tissues will be used to verify that improvements are occurring over the anticipated time frame, and determine whether an evaluation of the remedy effectiveness should occur.

3.1.1 Remedy Effectiveness Evaluation

Red drum will be used as the indicator species for the quantitative determination of remedy success. Red drum was selected because it represents a conservative species with the highest historical concentrations of mercury, it is one of the most frequently consumed species, it is a species that Texas Department of Health uses as a sentinel species in their monitoring programs, and red drum mercury concentrations were one of the principal reasons the site was originally placed on the Superfund list.

The baseline condition is that mercury concentrations of red drum tissues from the Closed Area are statistically higher than tissue concentrations from the Open Area. The remedy effectiveness evaluation provides a statistical approach that has been developed to decide whether mean mercury tissue concentrations in red drum in the Closed Area ("[Hg Closed]") have recovered to the levels seen in the Open Area ("[Hg Open]") and that the remedial action objectives for the Bay have been met.

The approach to remedy performance evaluation uses statistical hypothesis testing to evaluate whether mercury tissue concentrations in the Closed Area, which are currently elevated relative to the Open Area, have recovered to the levels in the Open Area. In other words, the approach quantitatively evaluates whether remediation has resulted in mercury levels in Lavaca Bay red drum similar to those that would be observed but for the historic release of mercury from Point Comfort operations.

The specific methods to conduct the statistical comparison of mercury concentrations in the Open and Closed areas are provided in Appendix A. Fish will be collected at sample sites representative of similar habitat types in both areas. The locations and corresponding habitat types of the sampling stations are described in Section 3.2.

3.1.2 Temporal Trend Analysis

The short-term trends in juvenile blue crab and red drum will be used as a “qualitative” means of evaluating the remedy effectiveness, but will not be used as a quantitative measure. Blue crab mercury concentrations will not be the basis for final determination of remedy success; red drum will be used for that purpose, as described above. Juvenile blue crab were selected in addition to red drum for evaluating temporal trends in mercury tissue concentrations because they should demonstrate a more rapid response time to changes in bioavailable mercury due to their lower trophic level, direct contact with sediments, and consumption of organisms directly tied to the sediment-food chain pathway. Juvenile blue crab concentrations will be evaluated for trends on annual basis using crabs collected in the fall of each year. Juvenile crabs between 25-75mm will be collected from the Closed Area, and one laboratory sample will be defined as the whole body composite samples consisting of 5 juvenile crabs.

Trends in mercury tissue concentrations of blue crab and redfish will be evaluated graphically. The direction of the juvenile blue crab concentration trends (increasing versus decreasing) and the magnitude of the trend (how fast are concentrations increasing or decreasing) will be used in a preliminary assessment of remedy effectiveness. An increasing trend would indicate that the sediment remedies are not being effective at reducing tissue concentrations, and would warrant consideration of additional remedial measures. A decreasing trend would indicate that the sediment remedies are having the desired initial effect, and would be confirmed with the red drum data to determine when the reduction has reached an acceptable level. A static or fluctuating trend would indicate that multiple parameters are affecting tissue concentration, and that further monitoring will be necessary, but that additional remedial measures may also be necessary.

3.2 SAMPLING LOCATIONS AND PROCEDURES

The monitoring program established as part of this OMMP will be a continuation of the previous Finfish and Blue Crab Monitoring Study in that this OMMP program will attempt to continue sampling at the sampling stations established previously. However, due to anticipated habitat changes within the Closed Area, new sampling stations may be established to meet the sampling objectives of this program. The OMMP program will utilize the same basic sampling strategy and analytical techniques approved for the Finfish and Blue Crab Monitoring Study, to ensure data compatibility. Sampling will be conducted as follows:

1. The Closed Area will be divided into quadrants, with the north/south, east/west dividing lines centered over Dredge Island.
2. Sampling will be conducted annually. A minimum of 30 samples (30 each for red drum and blue crab) will be collected from the Closed Area. The objective will be to collect approximately the same number of samples from each Closed Area quadrant to achieve a total of 30 total samples (i.e., approximately 7 to 8 samples per quadrant). This objective will provide an average concentration for the entire Closed Area based on equal geographic representation of the Closed Area (e.g. there will not be a bias of more samples from one region of the Closed Area versus another region).
3. Samples will be collected from the previously established stations, although additional stations may be added depending on netting success at each station. The number of samples from each station will be relatively uniform (i.e., If there are 4 stations in a quadrant, then there will be approximately 2 samples per station to provide a total of 7 to 8 samples for the quadrant. Stations sampled previously within the Closed Area that will be sampled in the future are depicted in Figure 2. As with any fish netting program, these stations represent target areas where fish collection will be attempted. Since netting success is variable, stations from which samples are collected and the number of samples per station will vary. The goal is to collect a uniform representation of the entire Closed Area following the station and sample selection protocol described above as closely as netting success allows.
4. Thirty additional samples will be collected from throughout Lavaca Bay outside the Closed Area (Figure 3). The proposed locations for these samples are indicated in Figure 3 and include stations in close proximity to the Closed Area as well as stations distant from the Closed Area in other regions of the Open Area of Lavaca Bay. The objective of the Open Area station selection is similar to the Closed Area in that the desire is to collect a geographically uniform representation of samples from throughout the Open Area. Due to netting

success variability, precise definition of sample sizes and locations is difficult to achieve. However, the general goal will be to collect 2-3 samples from 10 – 15 stations distributed evenly throughout the Open Area. Target stations are depicted in Figure 3.

5. Monitoring will be conducted annually in the fall until the performance standard has been met for a period of two consecutive years.

6. Fish and shellfish collection methods, tissue-processing methods, and laboratory analytical methods will follow the same protocol used during previous fish and shellfish monitoring events (Volume B12b: Finfish and Blue Crab Monitoring Study, 1997- 2001).

4.0 OPERATIONS, MAINTENANCE AND MONITORING CONSIDERATIONS

4.1 Schedule

The Fish and Shellfish Monitoring Plan described in this OMMP will begin in 2003 as required by the impending Consent Decree. However, in the interest of data continuity post ROD, Alcoa also conducted this sampling in 2002, with Agency concurrence. Therefore, some of the early years of data have been collected prior to all of the remedial activities being completed. For example, the enhanced natural recovery north of Dredge Island may not be implemented for several years until suitable maintenance or new work dredged material becomes available. Although trend analysis should not occur until the remedial activities are complete, Alcoa believes it is important to continue the long-term monitoring that has already been established by implementing this OMMP in 2002 in order to continue to add to the record of tissue data that has been collected at the site. As stated in the previous section, annual sampling will continue until the performance standard is met for two consecutive years.

4.2 Health and Safety and Monitoring

Issues related to the health and safety of project personnel have been addressed in the Project Specific Safety and Health Plan, included as an appendix in the attached Sampling and Analysis Plan.

4.3 Reporting Requirements

The analytical results collected as part of this OMMP will be reported to EPA, along with the results of other monitoring studies, on a yearly basis in the form of an annual monitoring report. Cumulative analytical results will be presented graphically and in summary tables, to provide data necessary for trend analyses and overall program evaluation.

5.0 REFERENCES

Alcoa, 1996. RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume A: Project Management Plan.

———, 1997a. RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume B12a: Finfish and Shellfish Sampling to Support Human Health Risk Assessment.

———, 1997b. RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume B12b: Finfish and Blue Crab Monitoring Study (1997- 2000);

———, 1998. RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume B12e: Bay System Fish and Bird Prey Item Study – Data Report.

———, 2000. Final Baseline Risk Assessment Report Alcoa (Point Comfort)/Lavaca Bay Superfund Site.

EPA, 2001. Record of Decision Alcoa (Point Comfort)/ Lavaca Bay Site, Point Comfort Texas, CERCLIS #TXD 008123168, United States Environmental Protection Agency Region 6 Superfund Division. December.

FIGURES

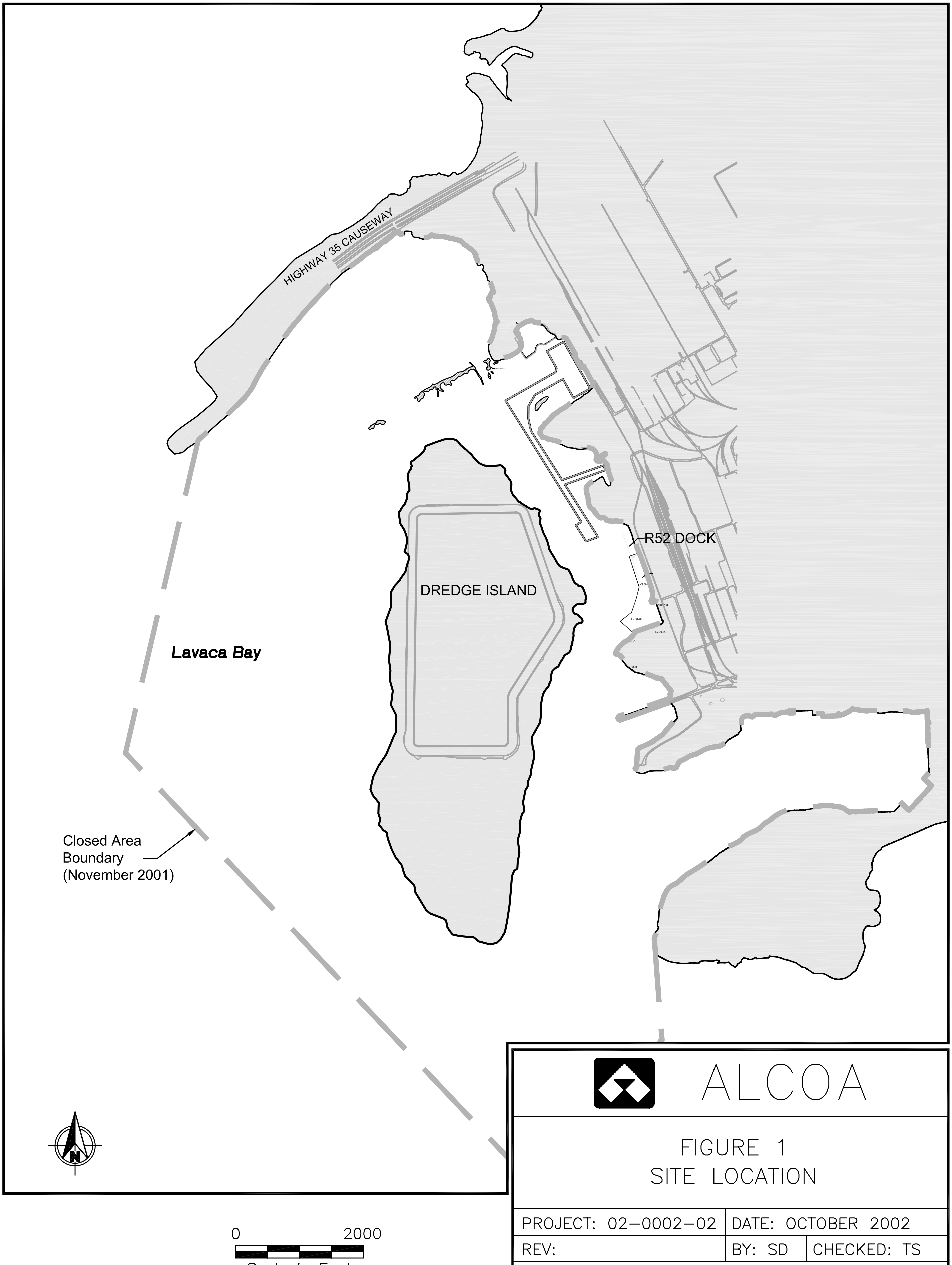

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FIGURE 1
SITE LOCATION

PROJECT: 02-0002-02	DATE: OCTOBER 2002
REV:	BY: SD CHECKED: TS

ALCOA
Point Comfort Operations

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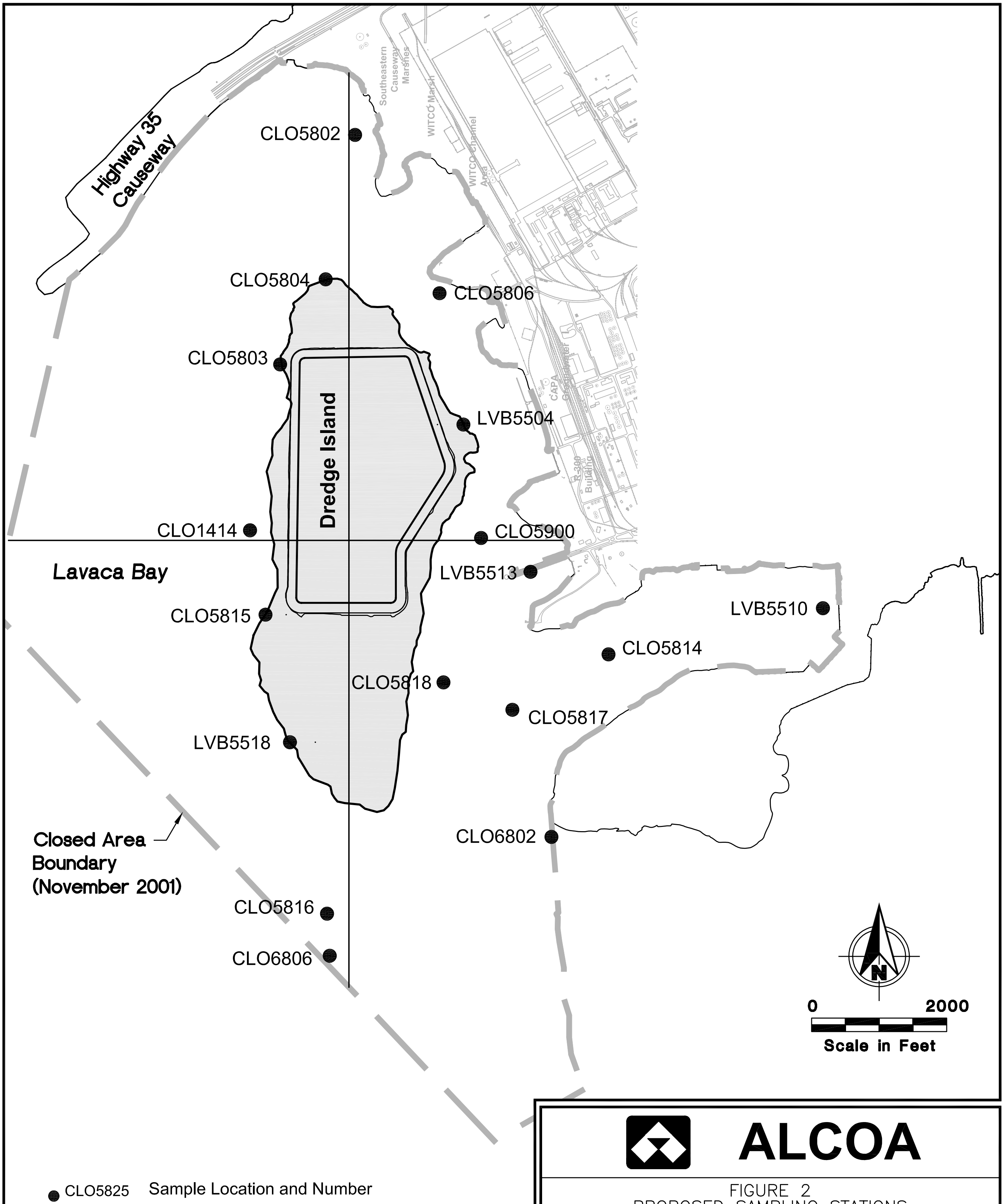

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FIGURE 2
PROPOSED SAMPLING STATIONS
(BASED ON HISTORICAL LOCATIONS)
FOR DETERMINING RED DRUM AVERAGE MERCURY
CONCENTRATIONS IN THE CLOSED AREA

PROJECT: 03–0002–04	DATE: OCTOBER 2003	
REV:	BY: SD	CHECKED:

ALCOA
Point Comfort Operations

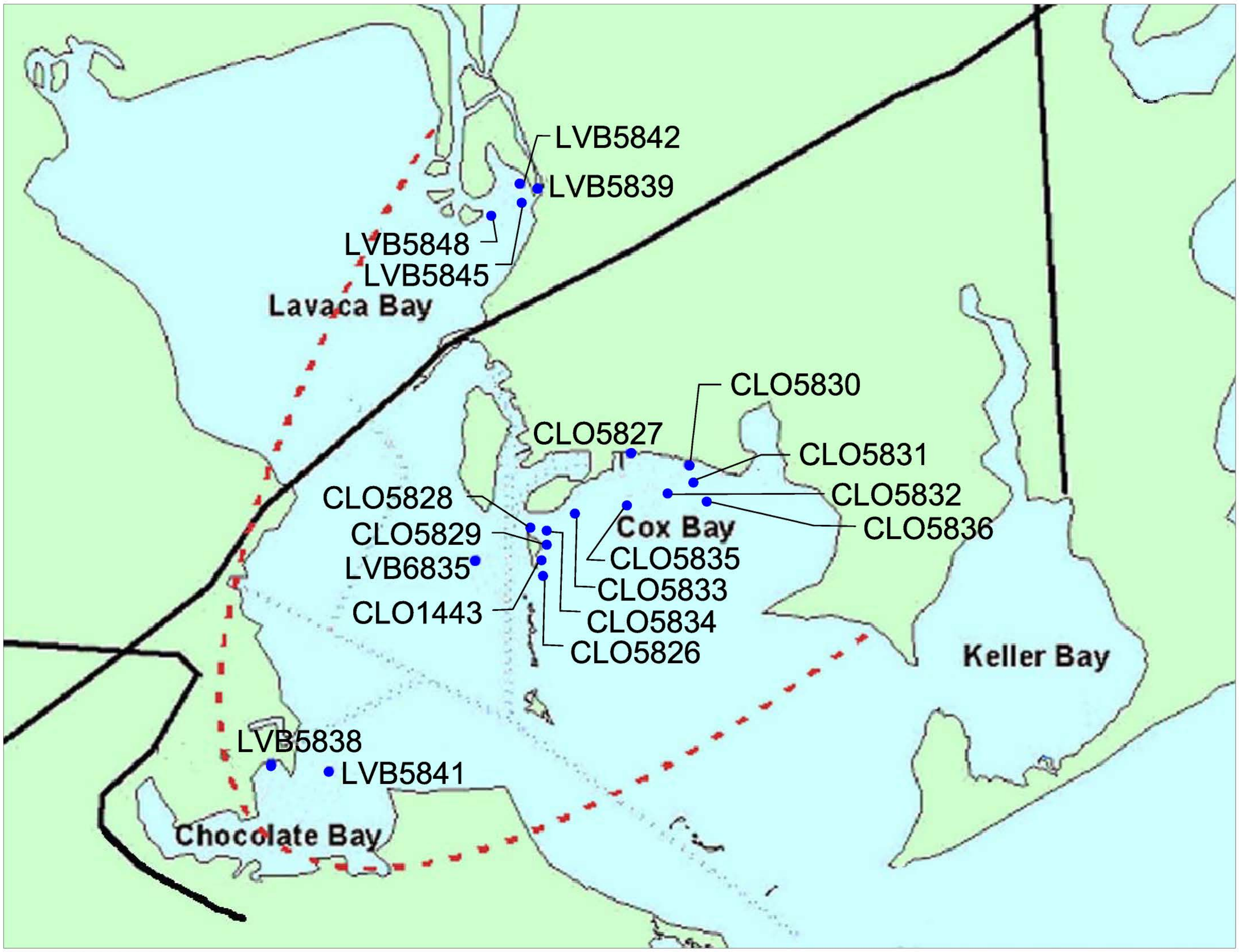

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FIGURE 3
PROPOSED SAMPLING STATIONS
(BASED ON HISTORICAL LOCATIONS)
FOR DETERMINING RED DRUM AVERAGE
MERCURY CONCENTRATIONS IN OPEN AREA

PROJECT: 03-0002-04	DATE: OCTOBER 2003	
REV:	BY: CD	CHECKED:

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APPENDIX A

DEVELOPMENT OF A STATISTICAL EVALUATION APPROACH AND METHODS FOR CONDUCTING STATISTICAL ANALYSES OF RED DRUM TISSUE

1 INTRODUCTION

This appendix provides background information on how the proposed evaluation approach was derived. This background focuses on determining the appropriate sample size to ensure statistically valid conclusions are being made regarding the red fish tissue concentrations; and determining the appropriate test type(s) that should be used in making those conclusions.

2 HYPOTHESIS DEVELOPMENT AND SAMPLE SIZE DETERMINATION

The approach to monitoring remedy performance uses statistical hypothesis testing to evaluate whether mercury tissue concentrations in the Closed Area, which are currently elevated relative to the Open Area, have recovered to the levels in the Open Area. In other words, the approach quantitatively evaluates whether remediation has resulted in mercury levels in Lavaca Bay red drum similar to those that would be observed but for the historic release of mercury from Point Comfort operations. In the USEPA (2000) data quality objectives process, the hypothesis is derived from the decision rule (Step 5) and the statistical approach provides a means to specify the limits on the decision errors (Step 6). The proposed decision rule is:

- If the mercury concentrations of red drum tissues from the Closed Area are statistically higher than tissue concentrations from the Open Area, then further assessment is required.
- If the mercury concentrations of red drum tissues from the Closed Area are not statistically different from tissue concentrations from the Open Area for two years in a row, then the remedy is effective and complete.

Based on the above decision rule, the following hypothesis test would be performed:

- Null Hypothesis: $[Hg_{Closed}] = [Hg_{Open}]$ or $[Hg_{Closed}] - [Hg_{Open}] = 0$
- Alternative Hypothesis: $[Hg_{Closed}] > [Hg_{Open}]$ or $[Hg_{Closed}] - [Hg_{Open}] > 0$

The overarching goal of the approach is to ensure that there is high confidence that the statistical test will result in the correct decision being made. Specifically, the concern is that large variances in tissue concentrations in both the closed and open areas may mask differences between the two areas, and cause the statistical test to conclude they are the same. Therefore, the variance of the existing data was considered in the power analyses performed to determine a sample size that provided adequate protection against false positive or false negative errors (Table 1).

Determining an acceptable limit on false negative decision error provides the assurance that the environment and human health are being adequately protected. The beta level (β) is the probability of committing a false negative error (i.e., the null hypothesis is not rejected when it is false). In the case of a false negative error, the incorrect decision would be $[Hg_{Closed}] = [Hg_{Open}]$. In other words, it would be inferred that recovery had occurred when it had not. The impact of this decision error is concluding that the remediation objectives have been met, when in fact, they have not.

Therefore, this is the type of error Alcoa and the regulators are most concerned with. The statistical power of a test, defined as 1- β allows the probability of Type II errors to be quantified. For this approach, no more than a 5 percent chance of a false negative decision error (β = 0.05) was considered necessary to ensure protection of human health and the environment.

The alpha level, α, is the probability of committing a false positive error (i.e., the null hypothesis is rejected when it is true). In this case, the incorrect decision would be, $[Hg_{Closed}] > [Hg_{Open}]$. In other words, it would be inferred that recovery had not occurred when it had. The impact of this decision error is the negative connotation to the public of continued contamination in the Closed Area, and unnecessary extension of the CERCLA process. For this approach, an alpha level of 10 percent (α=0.1) was considered to be acceptable.

Table 1. Summary of Type I (α) and Type II (β) Errors

Outcomes	Reject Null Hypothesis	Do Not Reject Null Hypothesis
Null Hypothesis is True	α Type I error (false positive/false rejection)	**Correct Decision** at appropriate power
Null Hypothesis is False	**Correct Decision**	β Type II Error (false negative/false acceptance)

As noted above, the test power used to develop the sampling approach was 95 percent. The statistical power of a test is the probability that the null hypothesis will be correctly rejected when it is false. Therefore, there is only a 5 percent chance (β) that the null hypothesis will be maintained when it is false. To provide further assurance that a recovery of tissue mercury concentrations has occurred, the null hypothesis will be maintained for two years in a row.[1]

The sampling design was optimized (Step 7, USEPA 2000) to achieve the limits on decision error that are described above. Based on the above hypothesis and specified α and β levels, site-specific data were used to estimate the necessary sample size to meet the power requirements. The descriptive statistics and power analysis were conducted using JMP Version 4.0 statistical software. The red drum tissue data collected for the years 2000 to 2001 were used to describe the natural variability of the system (Table 2).

Table 2. Summary of 2000 and 2001 Red Drum Mercury Data

Year	Sample Size	Mean Hg (mg/kg ww)	Standard Deviation
2000 Open	16	0.516	0.172
2000 Closed	27	1.55	0.798
2001 Open	15	0.492	0.227
2001 Closed	30	1.33	0.463

2002 data were not used in the analysis because the Open area sample size was small (n=6)

Tests of the above hypothesis for the 2000 and 2001 datasets both had post-hoc power greater than 99 percent and P-values substantially lower than 5 percent. Therefore, the sample sizes of approximately 45 fish were adequate to correctly reject the null hypothesis. However, as Lavaca Bay approaches the condition where $[Hg_{Closed}] = [Hg_{Open}]$, the detectable differences will not be as great and therefore, the same test would not be as powerful. In other words, as the means of the two areas become more alike, a larger sample size is required to protect against Type II errors.

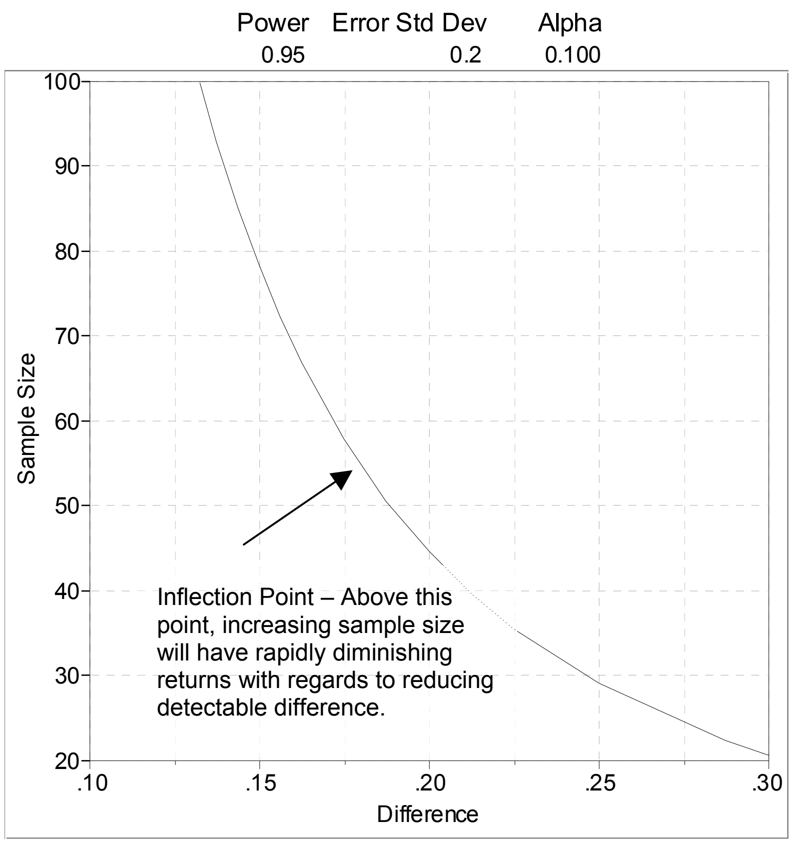
To evaluate the samples size necessary to achieve 95 percent power for the hypothesis test above when $[Hg_{Closed}] = [Hg_{Open}]$, a power curve was generated using $\alpha = 0.1$ and an error standard deviation ("ESD") of 0.2 (Figure 2). The combined ESD for the 2000 and 2001 Open Area data was 0.20 mg/kg ww, which was assumed to be representative of natural variation in the system.

Figure 2 shows the relationship between sample size and detectable difference. Detectable difference is the difference between the means that will result in the rejection of the null hypothesis. Achieving a detectable difference less than the

[1] Note that when the null hypothesis is maintained for two years, there is still a 5 percent chance of a Type II error because the samples are independent.

natural variance of the Open Area has the cost of requiring a very large sample size. In addition, a detectable difference less than the natural variance of the system is ecologically meaningless. A sample size of 60 was selected based on the inflection point in the power curve (Figure 2). Based on the site-specific variability of the system, a total sample of 60 (30 fish in each area) will provide a test power greater than 95 percent. Hypothesis tests conducted on these data should be able to detect differences in mercury concentrations between the Open and Closed areas 95 percent of the time, when they exist. The specific methods to conduct the statistical comparison of mercury concentrations in the Open and Closed areas are provided in Attachment B. The 60 total fish, targeted for 30 in each area, will be collected at sample sites representative of similar habitat types in both areas. The locations and corresponding habitat types of the sampling stations will be described in the final OMMP.

Figure 2. Power Curve - Relationship between Sample Size and Detectable Difference



3 STATISTICAL TEST METHODS

The recommended procedure to evaluate whether redfish tissue mercury concentrations have recovered to background levels is as follows:

- Sample up to 30 red drum each from the Open and Closed Areas for mercury analysis. Due to logistical constraints, this target number may not be achievable.
- Evaluate assumptions of normality using normal quantile plots and a Kolmogorov-Smirnov goodness of fit test. Evaluate equality of variance using Bartlett's test.
  - The 2000 and 2001 data had a typical log-normal distribution and variances of the Open and Closed Areas were not equal. In such a case, a standard one-tail t-test can be run adjusting for unequal variances. Variances should become more similar as tissue levels in the Closed Area become closer to those in the Open Area.
  - Transformations to the data should be made as appropriate. If the data are better fitted to a log-normal distribution, a logarithmic transformation may be appropriate prior to conducting the means testing. Quantile plots and a Kolmogorov-Smirnov goodness of fit test will be used to determine whether the untransformed or transformed data are more appropriate for use in the means test.
- If data are normally distributed, conduct a parametric means test (t-test). If the data are not normally distributed, also conduct anon-parametric means test (Wilcoxon/Mann-Whitney or equivalent).
- Conduct a post-hoc power analysis using the variance, mean differences, and sample size from the data to establish the event-specific decision error rates.
  - If necessary, discuss deviations from the statistical test assumptions
  - For years that [Hg $_{Closed}$] > [Hg $_{Open}$], the post-hoc power analysis will not inform the decision making.
  - For years when [Hg $_{Closed}$] = [Hg $_{Open}$], the post-hoc power analysis will provide the probability that a false positive error might have been made. To ensure that a Type II error has not been made when the null hypothesis is not rejected, statistical test assumptions should be met and the test power should be greater than 95 percent.

4 REFERENCES

USEPA. 2000. Data Quality Objectives Process for Hazardous Waste Site Investigations: EPA QA/G-4HW Final. United States Environmental Protection Agency, Office of Environmental Information, Washington, DC. EPA/600/R-00/007. January 2000.

UPDATE TO LAVACA BAY FINFISH AND SHELLFISH SAMPLING STANDARD OPERATING PROCEDURES

Appendix B2 to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019, contains the following standard operating procedures (SOPs) for finfish and shellfish monitoring:

- SOP-BESI-303: Collection of Finfish and Crabs Using Gill Nets
- SOP-BESI-304: Collection of Juvenile Blue Crabs Using Barrel Traps
- SOP-BESI-501: Sample Labeling and Chain-of-Custody Requirements
- SOP-BESI-506: Measuring Crab Carapace Width and Wet Weight
- SOP-BESI-508: Measuring Fish Length and Wet Weight
- SOP-BESI-509: Fish Tissue Processing
- SOP-BESI-520: Juvenile Blue Crab Whole Body Processing
- SOP-BESI-530: Red Drum Gut Content Surveys
- SOP-BESI-552: Sample Storage and Shipping Procedures for Red Drum and Juvenile Blue Crabs

STANDARD OPERATING PROCEDURE
SOP-BESI-303

TITLE: Collection of Finfish and Crabs Using Gill Nets

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. 2

Collection of Finfish and Crabs Using Gill Nets

1.0 PURPOSE AND APPLICABILITY

The purpose of this standard operating procedure is to obtain finfish and shellfish specimens from shallow aquatic habitats using gill nets. This SOP describes the proper procedures for using gill nets to collect finfish and crabs from shallow aquatic habitat. Gill nets are usually used in shallow water near the shoreline, but may be used in deeper water if properly weighted and anchored. Gill nets with different mesh sizes can be used to target specific sized fish. Gill nets are not legal in most states but can be used if persons using the nets are listed on a scientific permit. Non-target specimens must be released if they are alive. If non-target specimens are not alive they should be disposed of properly.

2.0 DEFINITIONS

There are no definitions applicable for this SOP.

3.0 HEALTH AND SAFETY CONSIDERATIONS

3.1 Nitrile gloves and approved safety glasses should be worn when conducting this procedure to protect personnel from possible contaminants that may be present in the water.

3.2 Proper lifting techniques should be utilized when handling heavy objects.

3.3 General boat safety criteria should be practiced at all times and includes awareness of other ship activities, wearing life jackets, monitoring marine radio, etc.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is conducted.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure and provide all the necessary information and data sheets to conduct the study. The task manager is responsible for assuring that:

- All necessary equipment is available
- Health and safety precautions are taken
- Enough information has been provided to locate sample area and stations.

6.0 EQUIPMENT AND MATERIALS

- Monofilament gill nets
- Wooden poles (2x2")
- Inertia driver (for wooden poles)
- Anchors (concrete blocks or small Danforth)
- Polypropylene or nylon rope (3/8-1/2 in diameter)
- Styrofoam floats
- Net picks
- Net tags
- Nitrile gloves
- Measuring board
- Plastic fish baskets (large)
- Re-sealable plastic bags

- Large fish storage bags
- Labels
- Permanent marker pens
- Ice chest with ice

7.0 TRAINING

Prior to conducting this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Gill nets can be purchased with many different mesh sizes and monofilament line strength. The size and strength of the primary target species will determine which mesh size and line strength should be used. e.g. for red drum, use number 12 monofilament, 4-6 inch stretch, 150 feet long, 6 feet high, with lead lines and float lines.

8.2 According to Texas law, gill netting is an illegal fishing method and may not be used unless persons using the nets are permitted by TPWD to use such methods. All gill nets must be tagged with the name of the user and the users TPWD permit number. Persons using gill nets must be in possession of a copy of the TPWD permit while the nets are in use.

8.3 Gill nets are used by vertically suspending the outstretched nets in areas where fish activity or traffic is suspected. Fish are caught in the nets as they attempt to swim through the mesh. Fish that are too large to pass through the mesh, will attempt to back out and will be snared by strands of the monofilament mesh under gills, scales, or spines.

8.4 Gill nets can be stretched across a fish pass or stream mouth, perpendicular to a shoreline, or parallel to a line of shoreline cover. Gill nets are set in an area used as a fish path or in an area that contains habitat utilized by the target fish species. Fish moving through or into the area may be caught in the net. A gill net is a passive fishing device and requires that the fish swim into it.

8.5 Gill nets are used by stretching the net across the area to be fished. An anchor should be attached to each end of the lead line of the net. Anchors hold the net down on the bottom and prevent it from being moved by water currents. Ends of the top line (float line) must be tied to structure (e.g., tree limbs, stumps, pilings) or a wooden stake driven into the bottom. For safety reasons, the stake should be visible above the waters surface.

8.6 Gill nets may be fished at any time the target fish are active, but they are generally most effective when set in the evening and fished through the night. Fish caught in the net will usually die quickly and should be removed from the net as soon as possible to prevent tissue deterioration. High water temperatures accelerate tissue deterioration.

8.7 A net is checked by raising it out of the water and removing captured fish from the mesh. Nets should be checked by starting at one end and working toward the other end. Fish are removed from the net by hand; a net pick may be used to remove the fish. Nitrile gloves are worn to protect the hands of personnel and prevent contamination of the sample.

8.8 Gill nets are generally set and checked from the deck of a boat, but in water less than 3 ft, it may be more efficient to check the net by wading. If waders or hip-boots are worn, a personal flotation vest should be worn.

8.9 Fish removed from the nets should be placed in a fish basket or plastic tub until they are evaluated. Non-target species that are still alive must be returned to the water immediately.

8.10 Fish should be put in a large labeled plastic bag and placed on ice in an insulated cooler.

8.11 Catch data should be recorded on data sheets.

9.0 QUALITY CONTROL CHECKS

Clean gloves will be worn at all times when handling the sampling equipment and samples.

10.0 DOCUMENTATION

General descriptive information of the sample site, catch, and field data should be entered in the field data log (SOP-BESI). Observations may include the following:

- Characteristics of the sample area, bottom type, vegetation, and water depth,
- Location of the area sampled,
- List of species collected, and,
- Number and/or weight of organisms collected,
- Water temperature, salinity, and conductivity.

NOTE:

FOLLOW ONLY THE MOST RECENT ISSUE OF THIS SOP.

STANDARD OPERATING PROCEDURE
SOP-BESI-304

TITLE: Collection of Juvenile Blue Crabs Using Barrel Traps

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. 2

Collection of Juvenile Blue Crabs Using Barrel Traps

1.0 PURPOSE AND APPLICABILITY

This SOP describes the proper procedures for collecting Juvenile Blue Crabs with barrel traps.

2.0 DEFINITIONS

There are no definitions applicable for this SOP.

3.0 HEALTH AND SAFETY CONSIDERATIONS

3.1 Nitrile gloves should be worn when conducting this procedure to protect personnel from possible contaminants that may be present in the sediment or organisms collected in the trap.

3.2 Proper lifting techniques should be utilized when handling heavy objects.

3.3 Personnel will be trained on how to handle blue crabs to avoid cuts caused by chelae or shells.

3.4 General boat safety criteria should be practiced at all times and includes awareness of other ship activities, wearing life jackets, monitoring marine radio, etc.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is conducted.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure and provide all the necessary information and data sheets to conduct the study. The task manager is responsible for assuring that:

- All necessary equipment is available
- Health and safety precautions are taken
- Enough information has been provided to locate sample area and sample stations.

6.0 EQUIPMENT AND MATERIALS

- Barrel Traps
- Ropes
- 2x2” Stakes
- 2x1.5” Survey Stakes
- Bait
- Plastic bucket or tub (sorting container)
- Re-sealable plastic bags
- Labels
- Measuring tape
- Permanent marker pens
- Ice chest with ice

7.0 TRAINING

Prior to conducting this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Prior to conducting the field sampling event, the entry holes at each end of the barrel traps are expanded by inserting a 1x2 inch survey stake through the entry holes. The increase in the size of the trap entry holes allows the full range of the target size of juvenile blue crabs (carapace width 25mm to 75mm) to enter the trap.

8.2 Sample station locations will be identified before each sample event is conducted.

8.3 A 2x2 inch stake will be inserted into the sediment at each juvenile blue crab sample station. Barrel traps will be tied-off to the stake. The number of traps set at each sample station, the set date, and set time will be recorded on field data sheets.

8.4 Barrel traps will be baited with commercial crab bait (when available) or bait fish captured from established 'clean' areas.

8.5 Traps will be placed in water deep enough to ensure they are completely submerged at high tide, but never entirely exposed to open air at low tide

8.6 The catch should be placed in a bucket or tub for sorting. After target organisms are removed, the remainder should be returned to the water. The total number of juvenile blue crabs captured, and number of juvenile blue crabs retained for processing will be recorded on field data sheets.

8.7 Juvenile blue crabs collected for processing will be placed in labeled re-sealable plastic bags and put on ice in a cooler. Plastic bags will be labeled with sample data, sample time, and sample station.

9.0 QUALITY CONTROL CHECKS

Clean gloves will be worn at all times when handling the sampling equipment and samples. Gloves must be changed between sample stations.

10.0 DOCUMENTATION

General descriptive information on the sample site, catch, and field data should be entered in the field data log. Observations may include the following:

- Characteristics of the sample area, bottom type, vegetation, and water depth,
- Tidal stage,
- Size of the area sampled,
- List of species collected, and,
- Number and/or weight of organisms collected,
- Water temperature, salinity, and conductivity.

NOTE:

FOLLOW ONLY THE MOST RECENT ISSUE OF THIS SOP.

STANDARD OPERATING PROCEDURE
SOP-BESI-501

TITLE: Sample Labeling and Chain-of-Custody Requirements

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. ___2_____

Sample Labeling and Chain-of-Custody Requirements

1.0 PURPOSE AND APPLICABILITY

To label sample containers with the correct information and effectively track the location of the samples at all times.

2.0 DEFINITIONS

There are no definitions applicable for this SOP.

3.0 HEALTH AND SAFETY CONSIDERATIONS

There are no health and safety issues applicable for this SOP.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must be also available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager is responsible for assuring that:

- All necessary equipment is available
- Proper shipping address is provided
- Proper analysis is marked on the Chain of Custody (COC)

6.0 EQUIPMENT AND MATERIALS

- Sharpies (permanent marker pen)
- Labels
- COC forms
- Pen
- Tape
- Large Ziploc®

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Sample Labeling:

8.1.1 The label will generally contain:

- Sample ID
- Sample Date
- Sample Time
- Empty sample container weight
- Sampler container number
- Initials of sampler

8.1.2 Field data logs will also be printed with the same information. Prior to use, check to ensure that the coded sample identification number on the label, and the field data logs are identical.

8.2 Chain-of-Custody Requirements:

8.2.1 An example of the chain-of-custody form is attached (Attachment A).

8.2.2 A chain-of-custody form will generally be completed for <u>each</u> sample type (matrix; e.g., water, sediment or tissue) collected or processed on a single day and it will stay with that sample type throughout shipping, storage, and analysis.

8.2.3 QA/QC samples (e.g., field blanks, duplicates, field spikes), can be entered on COC forms with the same matrix.

8.3 Completing the COC process

8.3.1 The chain-of-custody form consists of three color-coded pages: white, yellow and pink.

8.3.2 Record information on the top, white page, applying enough pressure so that the information is clearly legible on the yellow and pink carbon pages.

8.3.3 Once completed, put the chain-of-custody form in a re-sealable plastic bag, seal and store <u>with the appropriate sample(s)</u>.

8.3.4 Prior to shipping a cooler or package of samples, sign the chain-of-custody forms, and provide the date and time the samples are being relinquished for shipment.

8.3.5 Remove the pink copy of the forms and file them with the project records. Return the white and yellow copies to a plastic bag.

8.3.6 All chain-of-custody forms for samples to be shipped in a single cooler or package can be placed in a single plastic bag. The bag should be taped to the lid (inside) of the cooler/shipping package.

8.3.7 Seal the cooler/shipping package well and attach a signed chain-of-custody seal. NOTE: Generally, when the samples are received by the laboratory for analysis, the chain-of-custody forms will be signed on the "Received by" column and the yellow copy will be sent to BESI Study Director, Project Manager or designee. The white copy of the chain-of-custody form generally stays with the sample from collection through storage and analysis.

8.3.8 Staff collecting the samples should be those completing the COC forms. The field staff completing the COC form must also "relinquish" the samples.

8.3.9 If samples are held before shipping, the storage facility for the samples should be secure (locked or otherwise have limited access).

8.3.10 When the samples are removed from the holding facility, the sample integrity should be noted on the COC by the person removing the samples.

8.3.11 Personnel should then sign the "Relinquished by" column and fill out the date and time if transferring the samples to a cooler or carrier for shipment (e.g., sending in a cooler via Federal Express).

9.0 QUALITY CONTROL CHECKS

10.0 DOCUMENTATION

Attachment A **-** An example of the chain-of-custody form.

See Sample Shipping and Freezing Procedures SOP-BESI-502

USE ONLY THE MOST RECENT ISSUE OF THIS SOP

STANDARD OPERATING PROCEDURE
SOP-BESI-506

TITLE: Measuring Crab Carapace Width and Wet Weight

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne		11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin		11/05/18

Revision No. 2

MEASURING CRAB CARAPACE WIDTH AND WET WEIGHT

1.0 PURPOSE AND APPLICABILITY

This procedure provides the basic methodologies for measuring crab carapace width and wet weight prior to tissue processing for chemical analysis.

2.0 DEFINITIONS

Carapace - Large shell that forms protective covering on most crabs.
Carapace width - Lateral distance across the carapace from tip of spine to tip of spine.

3.0 HEALTH AND SAFETY CONSIDERATIONS

3.1 Nitrile gloves should be worn when performing this procedure.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager is responsible for assuring that:

- All necessary equipment is available; and
- All samples are prepared according to this procedure.

6.0 MATERIALS

- Calipers (stainless steel or Teflon)
- Electronic balance
- Labels
- Marking pens (permanent Marker pens)
- Chain-of-Custody forms
- Hexane
- Alconox (cleaner)
- Deionized Water

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Sample Preparation

Prior to handling any crab samples, all staff must wear nitrile gloves and all table surfaces should be scrubbed with a cleanser and covered with solvent rinsed aluminum foil. Next, remove the crabs from the sample containers or bags and rinse clean of all external debris (e.g., sand, plant material, etc.) using deionized water. The following sections describe the specific procedures to be followed for measuring and weighing the crab.

8.2 Crab Carapace Width Measurement

1. Using clean stainless steel or Teflon calipers, measure and record the distance in millimeters across the carapace from tip of lateral spine to tip of lateral spine.
2. Clean the calipers after each crab sample is complete with soap (Alconox) and deionized water, and rinse with ultra clean Hexane.

8.3 Crab Wet Weight

Note: These procedures assume the top loading balance has already been properly calibrated according to its respective SOP.

1. Place a piece of clean aluminum foil onto the weighing plate of a top loading balance and tare the balance to read, "zero".
2. Next, remove any excess water from the crab shell.
3. Place the crab on the tared scale making sure that the entire organism is on the aluminum foil.
4. Record the weight of the crab in grams to the appropriate significant digit (balance dependent) on the data log forms.
5. Discard the aluminum foil after each separate crab sample is weighed, and, if necessary, remove the weighing plate from the top loading balance and wash with soap (Alconox) and warm water, followed by deionized water.

9.0 QUALITY CONTROL CHECKS

Ensure that the top loading balance has been accurately calibrated, and all decontamination procedures are followed.

10.0 DOCUMENTATION

Detailed records should be kept to document routine calibration of the balance prior to each use as well as routine servicing by qualified technicians.

STANDARD OPERATING PROCEDURE
SOP-BESI-508

TITLE: Measuring Fish Length and Wet Weight

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. ___2______

FISH LENGTH AND WEIGHT PROCEDURES

1.0 PURPOSE AND APPLICABILITY

The purpose of this procedure is to accurately measure the length and weight of fish prior to tissue processing and chemical analyses. Whole fish samples will be collected in the field for chemical analysis. As soon as possible after collection, and prior to tissue removal and processing, accurate measurements of fish length and weight should be recorded. If fish weight is an important measurement, fish should be weighed as soon as possible after fish are removed from the water. Fish weight may decrease slightly due to fluid loss that can occur after the organism dies.

2.0 DEFINITIONS

Caudal Fin - posterior-most unpaired fin (i.e., tailfin).

Total Length - length from anterior-most point of nose to the tip of the longest caudal fin ray when the lobes of the caudal fin are compressed dorsoventrally.

Standard Length - length from the anterior tip of the nose to the posterior tip of the hypural plate.

Fork Length - length from the anterior-most point of the nose to the notch in the tail fin of fork-tailed fishes.

3.0 HEAL TH AND SAFETY CONSIDERATIONS

No specific health and safety considerations are necessary other than the general procedures outlined in the health and safety plan. Wash hands thoroughly with soap and water or disinfectant hand wipes after handling biota, nets and traps.

4.0 QUALITY ASSURANCE PLANNING CONSIDERA TIONS

No study-specific variances from this SOP are anticipated.

5.0 RESPONSIBILITIES

It is the field study manager's responsibility to ensure that all field staff are familiar with this SOP.

6.0 TRAINING/QUALIFICA TIONS

No special training or qualifications other than knowledge of this SOP are needed to accurately measure and weigh fish.

7.0 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Deionized water
- Electronic balance
- Measuring board
- Data log forms
- Decontamination materials
- Aluminum foil

8.0 METHODS

8.1 Sample Preparation

Prior to handling any fish samples, all staff must wear powder-free nitrile gloves and all table surfaces should be scrubbed with a cleanser and covered with solvent rinsed aluminum foil. Next, remove the fish from the sample containers or bags and rinse clean of all external debris (e.g., sand, plant material, etc.) using deionized (DI) water. The following sections describe the specific procedures to be followed for measuring and weighing the fish.

8.2 Fish Measurement

1. Place the fish on the measuring board on its side so that the tip of its nose (anterior) is touching the stop plate at the beginning of the fish measuring board.
2. Identify length of the fish corresponding to the desired measurement (i.e., total length, fork length, standard length) and record the value on the data log forms.

8.3 Fish Wet Weight

Note: These procedures assume the top loading balance has already been properly calibrated according to its respective SOP.

1. Place the fish on the tared scale and record the weight of the fish to the appropriate significant digit (balance dependant) on the data log forms.
2. Clean and tare scale prior weighing the next sample.

8.4 Fish Wet Weight

1. Once each fish is measured and weighed, attach a waterproof label to each fish using a zip tie. Record the sample station and fish ID number on each label. A hole punch will be used to put a hole in the water proof paper label and the zip tie will be used to attach the label to the fish through the mouth and gill plate.

9.0 QUALITY CONTROL CHECKS AND ACCEPTANCE CRITERIA

Ensure that the top loading balance has been accurately calibrated.

10.0 DOCUMENTATION

Detailed records should be kept to document routine calibration of the balance prior to each use as well as routine servicing by qualified technicians.

STANDARD OPERATING PROCEDURE
SOP-BESI-509

TITLE: Fish Tissue Processing

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. ____2_____

FISH TISSUE PROCESSING

1.0 PURPOSE AND APPLICABILITY

This procedure provides the basic methodologies for laboratory preparation of edible fish tissue samples for analysis.

2.0 DEFINITIONS

- Fish Scaler – a metal scraper with fingers or a sharp edge used to dislodge scales from fish skin.
- Fillet Knife – stainless steel knife with a long (10-12”), narrow (½”) blade.
- Stomach Cavity – the stomach cavity, or abdominal cavity, encloses the internal organs and is enclosed by a thin membrane called the peritoneum. Do not puncture the peritoneum with the fillet knife.
- Hexane – a volatile solvent used to de-grease (clean) sampling equipment.

3.0 HEALTH AND SAFETY CONSIDERATIONS

- Nitrile gloves should be worn when performing this procedure.
- Safety glasses should be worn while filleting tissue and while using hexane.
- Use of hexane should be under a fume hood or in a well-ventilated area.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager has responsibility for assuring that:

- All necessary equipment is available; and
- All samples are prepared according to this procedure.

6.0 EQUIPMENT AND MATERIALS

- Nitrile gloves
- Fish scaler
- Aluminum foil
- Electric fillet knife, fillet knife
- Stainless steel fillet knife blades
- Teflon cutting board
- Top loading balance (0.01 gm)
- Cooler (chest or upright)
- Decontamination materials: DI water, soap, ultra-pure hexane
- Scrub brushes
- Plastic tubs for washing tools
- Labels
- Marking pens
- Freezer grade resealable plastic bags
- Finfish processing forms
- Chain-of-Custody forms

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Pre-Preparation

Fish must remain on ice before processing. Remove each fish from the ice chest and plastic storage bag. Thoroughly rinse each fish with DI water to remove any debris. Measure, weigh, and label each fish (sample number) according to appropriate SOP (SOP-BESI-508).

8.2 Fish Scale Removal Procedure

- Remove fish scales from the right side of the fish using a fish scaler.
- Scales are removed to prevent scales from being included in the processed tissue sample.
- Be sure to remove scales near the dorsal fin and the under-side of the fish near the anal fin.
- Wear nitrile gloves and safety glasses when scaling fish.
- After the fish has been scaled, rinse the fish with DI water, and place it in a clean plastic bag.
- Store the bagged fish on ice until the fillet sample can be removed.

8.3 Body Tissue Removal Procedure

- Fillet the right side of the fish with your choice of pre-cleaned stainless steel utensils (electric fillet knife, regular fillet knife).
- Cut through skin and muscle, on the right side of fish above the centerline, perpendicular to centerline, behind the head.
- Place knife flat on backbone and anterior spines, and cut the fillet from the backbone from nose to tail.
- When the cut approaches the tail, turn the knife blade up, cut through the skin, and disconnect the fillet from the carcass.
- When filleting, do not puncture the stomach cavity and do not remove the skin. Sample fillet represents the total edible portion of the right fillet of each fish.
- Label sample container with sample number, date, sample technician ID.
- The sample jars provided by the analytical laboratory are not large enough to hold the entire fillet. Cut a 2 cm wide strip length-wise from the fillet and cut the strip into 2 cm cubes. Mix the cubes into a pile on the cutting board and randomly place 50 to 80 grams of the cubes into the sample jar. Record this weight as the sample weight.
- Place the lid on the sample jar and seal it in a quart size resealable freezer bag. Place the sample immediately into a refrigerator kept at 0 to 4ºC.

8.4 Decontamination Procedures

Decontamination of the filet knife blades and cutting boards used should follow this general sequence:

- Rinse with DI water and brush away large pieces of tissue.
- Clean apparatus with soapy water and brush.
- Rinse soap away with Dl water.
- Rinse thoroughly with ultra-pure hexane.
- Finally, triple rinse with DI water.

8.5 Equipment Storage

After use, all equipment must be thoroughly decontaminated with clean hexane and wrapped or covered with clean hexane-rinsed aluminum foil. Store equipment in an appropriate location.

8.6 Sample Handling and Shipment

Store samples in secure cold storage (0-4°C) until shipment. Ship samples in coolers with ice to the analytical laboratory via overnight carrier to arrive within 24 hours of processing.

9.0 QUALITY CONTROL CHECKS

Duplicates, Matrix Spikes, and Matrix Spike Duplicates will be submitted at a rate of 1 per 20 samples (5%).

10.0 DOCUMENTATION

When sending tissue samples to the analytical laboratory, follow the appropriate SOP for chain-of-custody and shipping documentation. Indicate in laboratory logbook that samples have been prepared and sent to the analytical laboratory for analysis. Sign and date all chart forms and logbook pages, as appropriate.

STANDARD OPERATING PROCEDURE
SOP-BESI-520

TITLE: Juvenile Blue Crab Whole Body Processing

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. ____2_____

JUVENILE BLUE CRAB WHOLE BODY PROCESSING

1.0 PURPOSE AND APPLICABILITY

This procedure provides the basic methodologies for laboratory preparation of juvenile blue crab whole body tissue samples for analysis.

2.0 DEFINITIONS

Carapace - Large shell that forms protective covering on most crabs.
Carapace width - Lateral distance across the carapace from tip of spine to tip of spine.

3.0 HEALTH AND SAFETY CONSIDERATIONS

- Nitrile gloves should be worn when performing this procedure.
- Safety glasses should be worn while processing samples and using hexane.
- Use of hexane should be under a fume hood or in a well-ventilated area.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager is responsible for assuring that:

- All necessary equipment is available; and
- All samples are prepared according to this procedure.

6.0 EQUIPMENT AND MATERIALS

- Nitrile gloves
- Teflon Cutting board
- Decontamination materials: DI water, soap, ultra-pure hexane
- Labels
- Marking pens
- Freezer grade Zip Loc
- Whole body processing forms
- Chain-of-Custody forms
- Deionized Water
- Alconox
- Aluminum Foil.

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Thoroughly rinse each crab with DI water to remove any debris. Measure and weigh each blue crab according to SOP-BESI-506.

8.2 A juvenile blue crab sample will consist of five crabs with a carapace width between 25 and 75 mm.

8.3 Place five juvenile blue crabs for each sample into a single jar provided by the analytical laboratory. Sample jars will be labeled as listed in SOP-BESI-501.

8.4 Place the lid on the sample jar and seal it in a quart size Ziplock freezer bag. Place the sample immediately into a refrigerator kept between 0 ºC and 4ºC

8.5 Decontaminate the Teflon cutting boards between processing each sample. Decontamination should follow this general sequence;

- Rinse with DI water.
- Clean apparatus with soapy water and brush.
- Rinse soap away with Dl water.
- Rinse thoroughly with ultra-pure hexane.
- Finally, triple rinse with DI water.

8.6 Equipment Storage

After use of all equipment, thoroughly decontaminate and wrap or cover all items with clean hexane-rinsed aluminum foil. Store equipment in an appropriate, clean location.

8.7 Sample Handling and Shipment

Samples will be stored and shipped as listed in SOP-BESI-552.

9.0 QUALITY CONTROL CHECKS

Duplicates, Matrix Spikes, and Matrix Spike Duplicates will be submitted at a rate of 1 per 20 samples (5%).

10.0 DOCUMENTATION

When sending tissue samples to the analytical laboratory, follow the appropriate SOP for chain-of-custody and shipping documentation requirements. Indicate in laboratory logbook that samples have been prepared and sent to the analytical laboratory for analysis. Sign and date all chart forms and logbook pages, as appropriate.

STANDARD OPERATING PROCEDURE
SOP-BESI-530

TITLE: Red Drum Gut Content Surveys

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. __2______

RED DRUM GUT CONTENT SURVEYS

1.0 PURPOSE AND APPLICABILITY

This procedure provides the basic methodologies for conducting red drum gut content surveys.

2.0 DEFINITIONS

There are no definitions applicable for this SOP.

3.0 HEALTH AND SAFETY CONSIDERATIONS

- Nitrile gloves should be worn when performing this procedure.
- Safety glasses should be worn while cutting in the gut cavity and stomach.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must also be available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager is responsible for assuring that:

- All necessary equipment is available; and
- All samples are prepared according to this procedure.

6.0 EQUIPMENT AND MATERIALS

- Nitrile gloves
- Aluminum foil
- Fillet knife
- Teflon cutting board
- Top loading balance (0.01 gram)
- Decontamination materials: DI water, soap, ultra-pure hexane
- Scrub brushes
- Plastic tubs for washing tools
- Labels
- Marking pens
- Camera
- Data sheets

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Do not start this procedure until after the red drum has been completely processed for chemical analysis and the sample has been removed from the processing area.

8.2 Using a fillet knife, open up the gut cavity exposing the stomach.

8.3 Using the fillet knife, cut the connections of the stomach to the esophagus and the stomach to the intestines and remove the stomach.

8.4 Place the stomach on the cutting board and remove the fish carcass from the processing area.

8.5 Cut the stomach open with the fillet knife and spread the contents of the stomach (if any) over the cutting board.

8.6 If possible count and identify each species found in the stomach and record the results on a field data sheet.

8.7 Place a label on the cutting board identifying which fish the gut content is associated with and take a picture of all the content and the label.

8.8 Place a piece of aluminum foil on the top loader balance and tare it. Place all the gut content on the aluminum foil and record the total weight on the field data sheet.

8.9 Dispose of the stomach and gut content with the fish carcass and clean the cutting board and fillet knife as listed in SOP-BESI-530.

9.0 QUALITY CONTROL CHECKS

No quality control checks are required for this SOP.

10.0 DOCUMENTATION

Record all data on field data sheets and take a minimum of one photograph of the gut content.

STANDARD OPERATING PROCEDURE
SOP-BESI-552

TITLE: Sample Storage and Shipping Procedures for Red Drum and Juvenile Blue Crabs

The attached Standard Operating Procedure was revised by:

Name	Signature	Date
Neil Henthorne	Neil Henthorne	11/05/18

The attached Standard Operating Procedure was reviewed by:

Name	Signature	Date
Russell Calvin	Russell Calvin	11/05/18

Revision No. ___2______

Sample Storage and Shipping Procedures for Red Drum and Juvenile Blue Crabs

1.0 PURPOSE AND APPLICABILITY

To ensure that samples are properly handled prior to shipment and are shipped to the analytical laboratory to arrive within temperature ranges and hold times listed in the SAP.

2.0 DEFINITIONS

There are no definitions applicable for this SOP.

3.0 HEALTH AND SAFETY CONSIDERATIONS

- Nitrile gloves should be worn when performing this procedure.
- Safety glasses must be worn when performing this procedure.

4.0 QUALITY ASSURANCE CONSIDERATIONS

This SOP must not be implemented until trained personnel are available to conduct this procedure. All necessary equipment, space, containers, and documentation materials must be also available before this procedure is performed.

5.0 RESPONSIBILITIES

The project manager must assign a task manager to conduct this procedure. The task manager is responsible for assuring that:

- All necessary equipment is available; and
- Prior to sample collection, the laboratory conducting analyses should be contacted by the Study Director, Project Manager, Field Crew Leader, or a designee to verify that the laboratory is prepared to accept the samples.

6.0 EQUIPMENT AND MATERIALS

- Cooler,
- Refrigerator
- Ice for cooler
- Chain of Custody Forms
- 2-gallon Ziploc bags
- Packing Tape
- Chain of Custody Seals
- FedEx shipping form
- Pen
- Sharpie

7.0 TRAINING

Prior to performing this SOP, responsible personnel (task manager and technicians) must read and understand this SOP.

8.0 METHODS

8.1 Preparation of Samples Prior to Shipment:

8.1.1 In the field, samples shall be stored on ice.

8.1.2 Tissue samples will be either placed in coolers containing ice or placed inside a refrigerator set at 4°C, until sample shipment occurs.

8.1.3 Fill out chain of custody (COC) form according to SOP-BESI-501 as soon as samples are processed. COCs will stay with samples at all times until the samples arrive at the analytical laboratory. Put COC form in plastic bag and tape to the inside top or lid of the sample shipment cooler, or place with sample containers in their storage area.

8.1.4 If in an environment where people other than project staff can access samples, seal the refrigerator or cooler with a chain-of-custody label or lock to protect against tampering.

8.2 Shipping Instructions:

8.2.1 Red Drum samples must be shipped to the analytical laboratory to arrive the day after the samples are collected and processed.

8.2.2 Juvenile blue crab samples must arrive at the analytical laboratory within seven days of collecting the first crab for each sample.

8.2.3 Only sample coolers in good condition will be used to ship tissue samples.

8.2.4 Sufficient ice to keep samples at or below 4°C while shipping will be placed in Ziplock bags and double bagged.

8.2.5 Samples will we be surrounded by ice on all sides in the sample cooler

8.2.6 A temperature blank will be placed in each sample cooler.

8.2.7 The appropriate COC forms will be placed in plastic bags and taped to the inside top or lid of the sample shipment cooler or placed with sample containers in their storage area.

8.2.8 The coolers will be sealed with packing tape and signed and dated COC seal will be placed on each sample cooler to be shipped.

8.2.9 All samples are to be shipped via overnight courier to the laboratory.

9.0 DOCUMENTATION

SOP-BESI-501 - Sample Labeling and Chain-of-Custody Requirements

UPDATE TO CHLOR-ALKALI PROCESS AREA GROUNDWATER REMEDIAL DESIGN REPORT AND OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix C to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Remedial Design Report (RDR) and Operations, Maintenance, and Monitoring Plan (OMMP) for Chlor-Alkali Process Area (CAPA) groundwater from September 2003 (Alcoa 2003[1]). Operation, maintenance, and monitoring of the CAPA groundwater extraction and treatment system are conducted in accordance with the schedule included in the original RDR and OMMP (Alcoa 2003), and sampling data are still compared to the discharge standards developed initially. Based on an evaluation of system data collected over the period of operation, some sampling and inspection activities are conducted more frequently than noted in the original RDR and OMMP (Alcoa 2003).

The only significant change to the operations, maintenance, and monitoring for CAPA groundwater is as follows:

- Lavaca Bay surface water monitoring (i.e., the sampling of surface water offshore of the CAPA) was discontinued in 2007 (Alcoa 2007[2]). Alcoa performed multiple surface water sampling events offshore of the CAPA to evaluate the potential discharge of mercury and carbon tetrachloride from groundwater to Lavaca Bay over a 9-year period. Data from those monitoring events confirmed that hydraulic control of groundwater beneath the CAPA was achieved by the extraction system and that additional surface water monitoring was not necessary.

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[1] Alcoa, 2003. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.
[2] Alcoa 2007. *2006 Remedial Action Annual Effectiveness Report*. Alcoa (Point Comfort)/Lavaca Bay Superfund Site. March 30, 2007.

Chlor-Alkali Process Area Groundwater

Remedial Design Report and

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

September 2003

ALCOA

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document represents the Remedial Design Report (RDR) and associated Operations, Monitoring, and Maintenance Plan (OMMP) for Chlor-Alkali Process Area (CAPA) Groundwater at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site (the "Site") in Point Comfort, Texas. For simplicity, this report will be called the "CAPA RDR."

Extraction and treatment of mercury-contaminated groundwater at the CAPA is a component of the Bay System remedy, as described in the Feasibility Study (FS) (Alcoa, 2001) and required by the Record of Decision (ROD) (EPA, 2001). This RDR presents an overview of the groundwater treatment system and the objectives of the remedial and monitoring program. This RDR is one of a series of RDRs and OMMPs that collectively provide the design for the entire Site remedy as defined in the ROD. These reports have been prepared as attachments to the Consent Decree.

1.2 SITE DESCRIPTION

The Site is defined in the Consent Decree. Specifically, the area covered by this RDR is the CAPA, located on the western portion of the Site near the Lavaca Bay shoreline (Figures 1-1 and 1-2). The CAPA encompasses that area of the plant where sodium hydroxide was produced from 1966 to 1979 for use in the bauxite refining process. Mercury cathodes were used in the electrolytic conversion of sodium chloride to sodium hydroxide, chlorine gas, and hydrogen. The chlorine gas was removed from the gas stream using carbon tetrachloride. Over time, releases of mercury and carbon tetrachloride occurred in the subsurface at the CAPA. A detailed description of the historical operations at the CAPA is contained in the *Preliminary Site Characterization Report* (PSCR) (Alcoa, 1995).

Contaminated groundwater discharging to Lavaca Bay from the Zone B aquifer underlying the CAPA was identified during the RI as an ongoing source of mercury to the bay (Alcoa, 1998b;

Alcoa 1999b; Alcoa, 2001). The shoreline in this area is mostly comprised of engineered material (e.g., concrete filled “fabriform”, riprap, and sheetpiling) that extends below the water line. Water depths along the shoreline are highly variable as a result of the maintenance dredging that routinely occurs (approximately every two years) to allow boat and barge traffic to reach the Plant. Figure 1-3 shows the bathymetry for the CAPA shoreline area.

1.3 REMEDY OVERVIEW

Extraction and treatment of mercury-contaminated groundwater at the CAPA is a component of the Bay System remedy, which also includes enhanced natural recovery of the area north of Dredge Island, dredging of the Witco Channel, dredging of the Witco Marsh, installation of a slurry wall vertical barrier at the Witco Area, stabilization of the Dredge Island, and removal of CAPA sediment via dredging. The CAPA groundwater extraction and treatment system controls one potential source of mercury recontamination to Lavaca Bay (i.e., CAPA groundwater). Monitoring of the effectiveness of the CAPA groundwater extraction and treatment system will be conducted as described in this RDR.

Extraction and treatment of groundwater at the CAPA was evaluated via a treatability study that was initiated in 1998 (Alcoa, 1999a) and has operated continuously since that time. Hydraulic control is conducted using four groundwater extraction wells located adjacent to the Lavaca Bay shoreline immediately downgradient of Building R-300 (Figure 1-4). An aggregate extraction rate of eight to 10 gpm from the four extraction wells creates a cone of depression that extends parallel to the shoreline for a distance of more than 200 feet along the line of wells (Alcoa, 1999a). Based on the observed potentiometric surface and reductions in surface water mercury and carbon tetrachloride concentrations measured in Lavaca Bay after groundwater extraction was initiated (Alcoa, 1999b), this hydraulic control appears to effectively mitigate the potential for migration of mercury-impacted groundwater in Zone B west of Building R-300 to Lavaca Bay.

Several treatment technologies for reducing the mercury and carbon tetrachloride concentrations in extracted groundwater were evaluated during the treatability study. The results of the technology evaluations indicated that each of the technologies tested were effective at reducing either mercury or volatile organic compound (VOC) concentrations in the

CAPA groundwater. Based on the best balance between cost and efficiency, aeration for VOC removal and carbon adsorption for mercury removal were selected as the most appropriate technologies.

Four focused shoreline surface water sampling events near the CAPA were conducted to evaluate the nature and extent of potential groundwater impacts to Lavaca Bay and the effectiveness of the treatment system. The first two sampling events were performed at various locations and depths to evaluate pre-groundwater extraction mercury and carbon tetrachloride concentrations in Lavaca Bay surface water. The results of these sampling events showed elevated total and dissolved mercury concentrations, as well as detectable carbon tetrachloride concentrations in almost all of the samples collected. The presence of carbon tetrachloride in particular indicated that CAPA groundwater was entering the Bay, since no other known sources of carbon tetrachloride exist (Alcoa, 1999b).

The third and fourth focused CAPA shoreline surface water sampling events were performed in June 1998 and June 1999, after the groundwater extraction and treatment system was operational. These sample results showed significant decreases in mercury and carbon tetrachloride concentrations in all surface water samples collected compared to pre-groundwater extraction values (Alcoa, 1999b), indicating that CAPA groundwater migration to Lavaca Bay was effectively controlled. Furthermore, the concentrations of filtered mercury in the samples decreased dramatically, consistent with the reduction of CAPA groundwater discharge as a source of mercury to surface water.

In July 2001, surface water samples were again collected offshore of the CAPA. The sample locations, methods and procedures for this event followed those outlined in this RDR/OMMP (see Section 3.3 and Appendix B). The analytical results confirmed the earlier results and were consistent with the conclusion that a reduction in CAPA groundwater discharge has occurred as a result of groundwater extraction. The results of all CAPA offshore surface water monitoring events are provided in Tables 1-1 and 1-2.

In the FS (Alcoa, 2001), numerous remedial action alternatives to control the movement of mercury in CAPA groundwater to Lavaca Bay, including the methods evaluated in the treatability study, were evaluated. Based on the treatability study data and the results of the detailed screening of alternatives in the FS, the recommended remedy for CAPA groundwater was extraction and treatment.

Since the extraction and treatment system is currently operating in the same manner as in the treatability study, no additional construction is required. Detailed information related to design and construction of the system is contained in Alcoa, 1997a and Alcoa, 1999a. This RDR, therefore, does not contain detailed design information. Operation, maintenance and monitoring of the extraction and treatment system is described in detail in Section 3.0 and Appendix A of this report.

The FS, the ROD, and this RDR formally incorporate the treatability study into the Site remedy.

1.4 PLAN REVIEW AND REVISION

This RDR will be reviewed at the end of each calendar year for the first five years following the Consent Decree. If warranted, appropriate revisions to sampling methods, frequency, performance objectives, health and safety procedures, etc., if any, will be proposed for Agency review in an effort to better meet the objectives of the remedy at the CAPA and Lavaca Bay. Upon Agency acceptance, the changes will be incorporated into the RDR for the remainder of the year, or until further changes are deemed necessary.

The sampling procedures presented in this RDR are based on methods that have been successful during previous site investigations and were typically procedures contained in approved documents from the RI. Future site conditions and/or changes in technology may necessitate modifications to these procedures. Any permanent modifications will be reported to the agencies for approval prior to implementation. Other temporary modifications (i.e., field decisions) will be documented and reported to the Agencies in a timely manner. For example, a temporary modification might result from access issues, i.e., whereby a sampling location is inaccessible and a nearby alternate location is used. An example of a permanent modification would be the permanent relocation of the sampling location.

2.0 REMEDIAL DESIGN

The remedial design for the CAPA was completed during the treatability phase and a full description of the system can be found in Alcoa, 1997a and Alcoa, 1999a. Groundwater is pumped from four extraction wells into the treatment system at an approximate rate of two gpm each, or an aggregate rate of eight to 10 gpm. The wells are located adjacent to the Lavaca Bay shoreline, immediately downgradient of Building R-300, and are used to extract groundwater and create a hydraulic barrier to the flow of mercury-contaminated groundwater to Lavaca Bay. The wells are screened across Zones B1 and B2 (except for well CA0U23B, which is screened only in Zone B) which have been shown to be hydraulically connected. Aboveground jet pumps, with the intakes set approximately 15 feet above the base of the well, are used to recover the groundwater.

The treatment system consists of the following primary components: a programmable logic controller (PLC), a 500-gallon equalization tank (Tank-1), a pH control system (consisting of a chemical feed pump and controller supplying 30 percent or 50 percent sulfuric acid), a tray air stripper (ORS Model LoPro II using five trays), two bag filters connected in parallel, and three, 1,000 pound GAC vessels (GAC-A, GAC-B, and GAC-C). A process flow diagram and treatment compound plan for the groundwater treatment system are presented in Figures 2-1 and 2-2, respectively.

Groundwater is pumped from the extraction wells to the equalization tank (Tank T-1). Sulfuric acid is added to Tank T-1 to maintain the pH of the groundwater between 5.0 and 5.5 in order to limit the amount of scale build-up in the aeration system. The water from Tank T-1 is directed to the air stripper where carbon tetrachloride, chloroform, and other VOCs are removed from the groundwater. The air exhaust is discharged to the atmosphere 45-feet above ground level. Air emissions control was not found to be necessary, as discussed in Workplan Refinement Notice No. M3-RN06 (Alcoa, 1998a).

Air stripper effluent is pumped from the stripper sump through one of two bag filters, and into the series of three GAC vessels that contain approximately 1,000 pounds of carbon each. System effluent is discharged directly to Lavaca Bay through a discharge pipe located just south of the

R-10 dock, south of the CAPA (Figure 1-3). The effluent standards for this discharge are met prior to the water being discharged to Lavaca Bay.

3.0 OPERATION, MAINTENANCE, AND MONITORING

3.1 TREATMENT SYSTEM OPERATION AND MAINTENANCE

The groundwater treatment system operates continuously (except during routine maintenance and/or down-time due to occasional system malfunction) and system operation is monitored using a programmable logic controller and software program (Wonderware). This program monitors all principal system functions and alerts maintenance personnel when a system alarm has been activated (e.g., when flow from one or more of the recovery wells has stopped). Maintenance personnel are currently alerted immediately via email and alpha-numeric pager. In general, this process results in the system being non-operational due to malfunction for no longer than 24 hours. As discussed in the Groundwater Treatability Study Report (Alcoa, 1999a), a temporary interruption in the operation of the extraction wells should not create a situation where groundwater reverses flow to the point where it will discharge to the Bay.

Each week, maintenance personnel check the system, record critical system data (system pressures, flow rates, etc.), and collect samples to evaluate compliance with discharge requirements. Maintenance is performed on an as-needed basis. As noted in Section 1.4, the monitoring parameters and frequency will be evaluated as additional operational data are collected.

The primary recurring maintenance operations include:

- Replacement of the carbon in the GAC canisters;
- Replenishment of the acid supply; and
- Replacement of treatment system components as necessary (e.g., extraction pumps, bag filters, etc.).

The carbon in the primary carbon vessel is replaced as the mercury and VOC adsorption capacity is exhausted. The carbon vessel with the virgin carbon is then placed at the downstream end of the carbon treatment train to serve as the final polishing carbon vessel. What was the second carbon vessel then becomes the primary carbon vessel, and the former polishing vessel then becomes the second carbon vessel in the series. This cycle is repeated as the primary canister is exhausted (approximately every 6 months). The acid supply is replenished as necessary.

Potential long-term Operation and Maintenance (O&M) issues identified during the treatability study and subsequent operation of the groundwater treatment system include:

- The presence of carbon tetrachloride DNAPL in three of the four groundwater extraction wells, and
- The formation of elemental mercury on stainless steel surfaces within the treatment system.

Carbon tetrachloride DNAPL is an operational issue since measures must be taken to ensure that the DNAPL does not enter the treatment system with the extracted groundwater. As discussed below, DNAPL levels are measured in extraction well CA052B (which has historically been the only location to accumulate carbon tetrachloride DNAPL to a thickness that would enter the treatment system) on a monthly basis and removed when the thickness approaches two feet. In addition, the groundwater extraction pump intakes have been placed at 15 feet above the base of each well.

After the system was placed in operation, elemental mercury began to be observed on the stainless steel pumps/piping installed in the wells. It was determined that dissolved ionic mercury was being converted to elemental mercury in a galvanic reduction reaction with the stainless steel equipment. To alleviate this concern, all down-well stainless steel components were removed from the system and replaced with PVC (i.e., the submersible stainless steel pumps were replaced with aboveground jet pumps equipped with PVC intake pipes and foot valves).

3.2 PERFORMANCE OBJECTIVES AND STANDARDS

The performance objectives for the CAPA Groundwater Treatment System (GWTS) include the following:

- Compliance with the standards for discharge of treated water to Lavaca Bay; and

- Demonstration of hydraulic control, as indicated by evaluation of water-level data, measured flow volumes from recovery wells, and/or bay surface water mercury and carbon tetrachloride concentrations.

Monitoring parameters and allowable discharge concentrations for treated groundwater are shown in Table 3-1. Samples collected to comply with the discharge standards are collected weekly. The daily average concentration is the arithmetic average of all samples collected within each month (minimum of four samples). The daily maximum is the maximum sample concentration measured within each month.

TABLE 3-1

TREATMENT SYSTEM DISCHARGE STANDARDS[1]

PARAMETER	DAILY MAXIMUM	DAILY AVERAGE	MONITORING FREQUENCY
Flow	Report in MGD	Report in MGD	Continuous
pH	NA	6.0 to 9.0 s.u.	Weekly Grab
Mercury	0.010 mg/L	0.005 mg/L	Weekly Grab
Carbon Tetrachloride	0.380 mg/L	0.142 mg/L	Weekly Grab
Chloroform	0.325 mg/L	0.111 mg/L	Weekly Grab
Tetrachloroethene (PCE)	0.164 mg/L	0.052 mg/L	Weekly Grab

Notes:
[1]EPA, 1998

Weekly sampling of the treatment system effluent is conducted as described in Section 3.4. The carbon in the primary treatment vessel (Figure 2-2) is replaced when effluent concentrations from the final polishing vessel approach the discharge treatment standards. Sampling of the treatment system discharge to date has shown that the discharge concentrations can meet both the average and maximum discharge concentrations.

The effectiveness of the hydraulic control aspect of the treatment system will be monitored using Zone B water level monitoring data, measured groundwater extraction rates, and/or bay surface water sampling (see Section 3.4). Zone B water level monitoring typically indicates that the potentiometric groundwater surface is below the Lavaca Bay surface water level when the extraction rate is optimal (at the design rate of 8-10 gpm total for all wells). A hydrograph showing the water-level elevations in the pumping wells and Lavaca Bay is included as Figure 3-1.

Carbon tetrachloride and filtered mercury concentrations in surface water samples will be compared to the Texas surface water quality standards (Table 3-2). These standards are for human health protection (fish ingestion) in saltwater (30 *TAC* §307.6(d)(1)).

TABLE 3-2

SURFACE WATER MONITORING CRITERIA

COMPOUND	CRITERIA[1]
Carbon Tetrachloride	5.6 μg/L
Filtered Mercury	0.025 μg/L

Notes:
[1]30 *TAC* §307.6(d)(1)

Filtered mercury concentrations from surface water samples will be compared to the total mercury water quality standard since filtered concentrations are more likely to be indicative of groundwater flux to Lavaca Bay (i.e., mercury-contaminated groundwater discharge from CAPA to the Bay would likely contain little suspended solids).

From time to time, these standards are revised by the Texas Commission on Environmental Quality (TCEQ) or other agencies. If the mercury or carbon tetrachloride standard is revised, the surface water monitoring program will be evaluated in the context of the new standard(s). The new standard will not necessarily be adopted.

Detection of filtered mercury and carbon tetrachloride concentrations above these criteria in surface water samples collected offshore of the CAPA would indicate that flux to the Bay from CAPA groundwater was potentially occurring, though the flux may not indicate a risk to human health and the environment. Detection of dissolved mercury concentrations in surface water samples, but not carbon tetrachloride, would indicate that possibly other sources of mercury were entering the Bay. Other potential sources of mercury in the vicinity could include Outfall 001 and/or partitioning of mercury from contaminated sediments near the CAPA shoreline.

A contingency plan has been developed in the event that the surface water quality standards are exceeded. Figure 3-2 is a logic diagram showing the steps that will be followed if one or more of the surface water monitoring standards is exceeded.

3.3 LAVACA BAY SURFACE WATER MONITORING

Lavaca Bay surface water monitoring will consist of the collection and analysis of water column samples for measurement of filtered mercury and carbon tetrachloride concentrations. Samples will be collected at three different depths (surface, mid-depth, bottom) at seven stations (LVB9002, LVB9005, LVB9007, LVB9008, LVB9009, LVB9011, and LVB9012) along the CAPA shoreline during an ebbing tide to maximize expected groundwater flux to the Bay (Figure 3-3). These are the same stations used during previous offshore surface water sampling events (Alcoa 1999b, Alcoa 2001). In addition, samples will also be collected at one station (LVB9009) every eight hours for one, 24-hour period to evaluate diurnal groundwater flux to the Bay. Station LVB9009 is located just offshore from the R-300 building and is positioned such that it intercepts the area where the Zone B aquifer outcrops into the ship channel (Figure 3-3).

Samples initially will be collected two times per year (Spring and Fall) to assess periods of high and low flow conditions for two years. Samples will be collected and analyzed using the same methods as used during the focused CAPA shoreline sampling events. Sampling and analysis procedures are detailed in the attached Sampling and Analysis Plan (Appendix B).

The surface water sampling results will be compared to the Texas surface water quality standards (see Section 3.4).

3.4 TREATMENT SYSTEM MONITORING

The purpose of the CAPA groundwater treatment system monitoring program is to ensure continued proper mechanical operation of the system equipment and to evaluate compliance with the treatment system discharge standards (see Section 3.3). Monitoring activities for the treatment system include (Table 3-3):

1. collecting treatment system effluent samples for analyses of mercury and chlorinated VOCs on a weekly basis to evaluate compliance with discharge standards;
2. collecting effluent samples from the primary carbon vessel for total mercury analysis on a quarterly basis to evaluate carbon saturation in the vessel;
3. collecting chlorinated VOC samples from the air stripper effluent on a semi-annual basis to evaluate VOC removal efficiency;
4. collecting samples from the four extraction wells for total mercury and chlorinated VOC analyses on an annual basis to evaluate changes in influent mercury and VOC concentrations and to calculate emissions rates for the stripper;
5. recording flow rates and pressure readings from all system pumps on a weekly basis;
6. measuring water levels and carbon tetrachloride DNAPL thicknesses on a quarterly basis; and
7. removing carbon tetrachloride DNAPL from well CA052B on an as-needed basis.

TABLE 3-3

TREATMENT SYSTEM MONITORING ACTIVITIES

MONITORING ACTIVITY	ANALYSES	FREQUENCY
Check and record air stripper blower flow rate and pressure	N/A	Weekly
Check and record pressure, flow rate and flow totalizer from groundwater extraction pumps and groundwater transfer pumps	N/A	Weekly
Check and record system pressures (before the pre-carbon bag filters and before the primary carbon canister)	N/A	Weekly
Check and record groundwater levels and carbon tetrachloride DNAPL thicknesses in extraction wells and selected wells and piezometers	N/A	Quarterly
Check DNAPL levels in CA052B	N/A	Monthly
Remove carbon tetrachloride DNAPL from wells when greater than 2 feet thick	N/A	As Needed
Sample primary carbon canister effluent	Total mercury	Quarterly
Sample treatment system effluent	Total mercury, chlorinated VOCs, and pH	Weekly
Sample air stripper effluent	Chlorinated VOCs	Semi-annually
Sample extraction wells	Total mercury and chlorinated	Annually

	VOCs	

Sampling methods and analytical protocols will remain the same as those described in Alcoa, 1997a. The groundwater treatment system monitoring Standard Operating Procedures are provided in Appendix A.

4.0 ADDITIONAL OPERATION, MAINTENANCE, AND MONITORING CONSIDERATIONS

4.1 SCHEDULE

The groundwater treatment system has been operating continuously since May 1998 (with minimal downtime for maintenance and/or minor troubleshooting). Alcoa will continue to operate the treatment system until operation of the system is not necessary, as agreed upon by Alcoa and the regulatory agency responsible for project oversight.

The monitoring and maintenance schedule is discussed in Section 3.0.

4.2 HEALTH AND SAFETY

A Health and Safety Plan (HSP) addressing the operation and maintenance of the groundwater extraction and treatment system was originally prepared in 1997 (Alcoa, 1997a). The HSP has since been updated to reflect current operating conditions and a current copy is maintained on site at all times.

The Lavaca Bay surface water sampling will require special considerations including sample collection from a boat, SCUBA diving, and collection of samples at night under low-light conditions. In addition, sampling will take place in an area that usually experiences light to heavy barge and other boat traffic. All of these items are addressed in the attached Field Sampling and Analysis Plan for CAPA Offshore Surface Water Monitoring (Appendix B).

4.3 REPORTING REQUIREMENTS

The analytical results collected as part of this RDR, along with other monitoring information, will be reported to the regulatory agencies on an annual basis in the Remedial Action (RA) Annual Effectiveness Report, as required by the Consent Decree.

5.0 REFERENCES

Alcoa, 1995. *Preliminary Site Characterization Report for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1996. *Project Management Plan for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1997a. *RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume M3: Chlor-Alkali Process Area Groundwater Treatability Study Workplan.* July.

———, 1997b. *RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume B6L: Chlor-Alkali Process Area Focused Investigation.* September.

———, 1998a. *Workplan Refinement Notice No. M3-RN06.* May 11.

———, 1998b. *RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Data Report Volume B6L: Chlor-Alkali Process Area Focused Investigation.* July.

———, 1999a. *RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Data Report, Volume M3: Chlor-Alkali Process Area, Groundwater Treatability Study*, October.

———, 1999b. *Remedial Investigation Report, Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* November.

———, 2001. *Feasibility Study, Alcoa (Point Comfort)/Lavaca Bay Superfund Site.*

United States Environmental Protection Agency (EPA), 1998. Letter from Mr. Gary Baumgarten to Mr. Ron Weddell of Alcoa Point Comfort Operations Regarding Chlor-Alkali Process Area Groundwater Treatability Study. July 20.

———, 2001. Record of Decision Alcoa (Point Comfort)/Lavaca Bay Superfund Site.

TABLES

TABLE 1-1
CAPA OFFSHORE SURFACE WATER RESULTS - MERCURY

		Pre-Containment				Post-Containment				
	SAMPLE	Jan-98		Feb-98		Jun-98		Jun-99		Jul-01
LOCATION	DEPTH	Unf.	Filtered	Unf.	Filtered	Unf.	Filtered	Unf.	Filtered	Filtered
LVB9002	Surface	0.059	0.087	0.112	0.0227	0.024	0.00469	0.00655	0.00122	0.00173
	Mid-level	0.322	0.183	0.0362	0.0038	0.021	0.00253	0.00778	0.00101	0.000966
	Bottom	0.0419	0.0198	0.034	0.00652	0.0192	0.0023	0.0146	0.00131	0.000988
LVB9005	Surface	0.116	0.0252	0.121	0.0327	0.0255	0.00461	0.00648	0.00121	0.00141
	Mid-level	0.0334	0.0092	0.2135	0.0461	0.0194	0.00338	0.00727	0.00113	0.00126
	Bottom	0.0263	0.186	NS	NS	0.0533	0.00252	0.0211	0.000951	0.00107
LVB9007	Surface	NS	NS	0.0505	0.00794	0.0313	0.00325	0.00865	0.00156	0.00158
	Mid-level	NS	NS	0.0812	0.00412	0.0251	0.0021	0.0117	0.00106	0.0012
	Bottom	NS	NS	0.0875	0.0058	0.0248	0.00328	0.00736	0.00115	0.00116
LVB9008	Surface	NS	NS	0.169	0.0439	NS	NS	0.00676	0.00173	0.00145
	Mid-level	NS	NS	NS	NS	0.0269	0.00182	0.0277	0.00121	0.00119
	Bottom	NS	NS	NS	NS	NS	NS	0.0546	0.00135	0.00124
LVB9009	Surface	NS	NS	0.0704	0.0317	0.0218	0.00209	0.00624	0.00144	0.00147
	Mid-level	NS	NS	0.0976	0.0267	0.0408	0.0029	0.00886	0.001	0.00104
	Bottom	NS	NS	0.29	0.161	0.0273	0.00202	0.0196	0.000985	0.00108
LVB9011	Surface	NS	NS	0.0242	0.00613	0.0148	0.00293	0.00626	0.00117	0.00166
	Mid-level	NS	NS	0.039	0.00628	0.0296	0.00224	0.00451	0.000753	0.00104
	Bottom	NS	NS	0.0111	0.00147	0.0264	0.0022	0.00849	0.000876	0.00115
LVB9012	Surface	NS	NS	0.0144	0.00497	0.0284	0.00511	NS	NS	0.00202
	Mid-level	NS	NS	0.0167	0.00249	0.0179	0.00247	NS	NS	0.00118
	Bottom	NS	NS	0.0211	0.00364	0.0177	0.00203	NS	NS	0.00103

May 1998 Containment

Notes:
1) "Unf." indicates a sample that was filtered prior to analysis.
2) All samples reported in ug/L
3) The detection limit for mercury was 0.000168 ug/L.

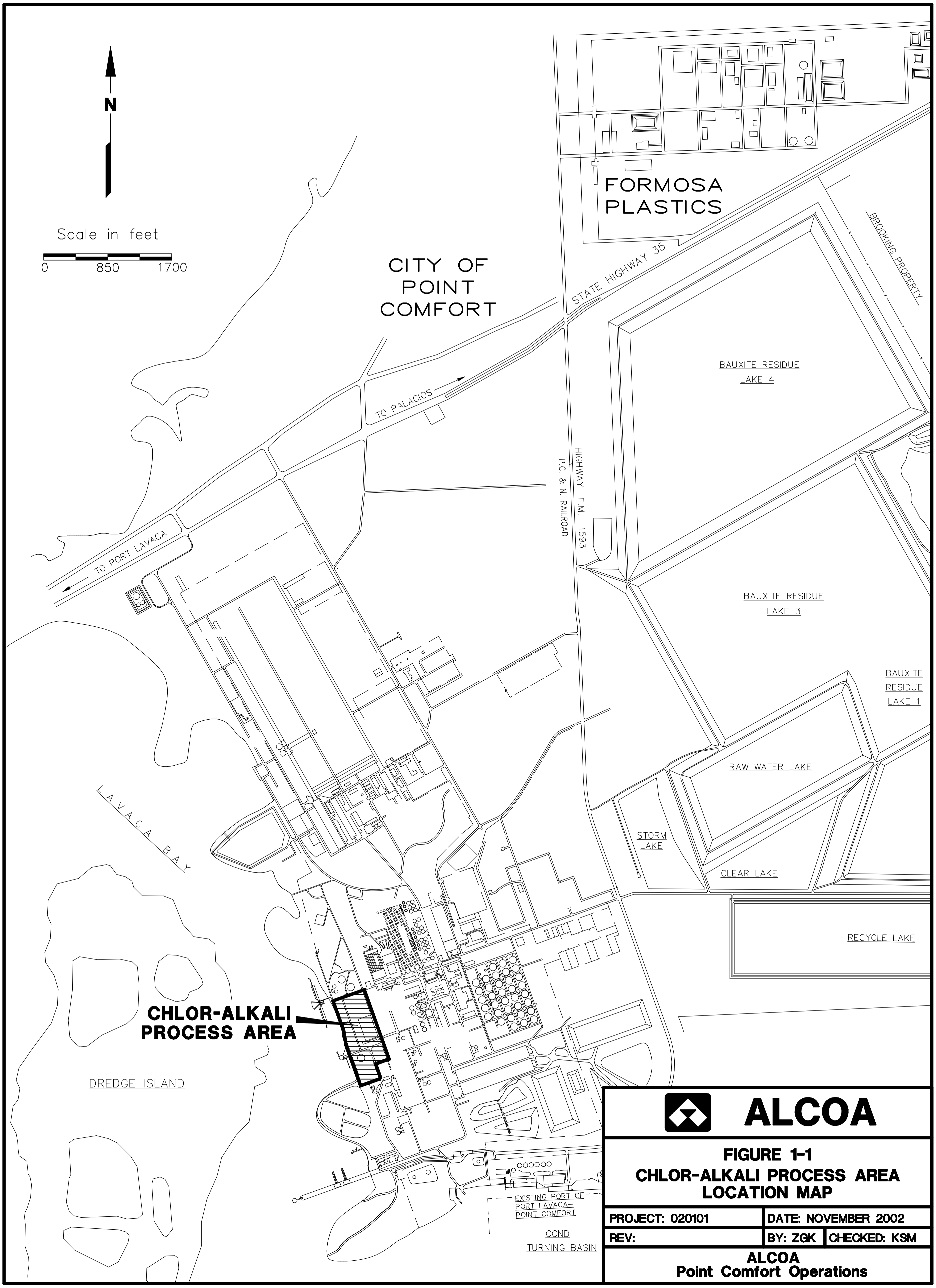
TABLE 1-2
CAPA OFFSHORE SURFACE WATER RESULTS - CARBON TETRACHLORIDE

		Pre-Containment		Post-Containment		
LOCATION	SAMPLE DEPTH	Jan. 8, 1998	Feb. 9, 1998	Jun. 10, 1998	Jun. 16, 1999	Jul. 24, 2001
LVB9002	Surface	1.68	3.6	ND	ND	0.028 U
	Mid-level	6.35	ND	ND	0.0141 J	0.028 U
	Bottom	1.74	0.6	ND	ND	0.028 U
LVB9005	Surface	2.18	4.33	ND	ND	0.028 U
	Mid-level	ND	7.42	ND	ND	0.028 U
	Bottom	ND	NS	ND	0.0196 J	0.028 U
LVB9007	Surface	NS	0.75	ND	ND	0.028 U
	Mid-level	NS	ND	ND	ND	0.028 U
	Bottom	NS	0.43	ND	ND	0.028 U
LVB9008	Surface	NS	3.99	NS	ND	0.028 U
	Mid-level	NS	NS	ND	ND	0.028 U
	Bottom	NS	NS	NS	ND	0.028 U
LVB9009	Surface	NS	2.73	ND	ND	0.028 U
	Mid-level	NS	0.94	ND	ND	0.028 U
	Bottom	NS	1.41	ND	ND	0.028 U
LVB9011	Surface	NS	ND	ND	ND	0.028 U
	Mid-level	NS	1.14	ND	ND	0.028 U
	Bottom	NS	ND	ND	ND	0.028 U
LVB9012	Surface	NS	ND	ND	NS	0.028 U
	Mid-level	NS	ND	ND	NS	0.028 U
	Bottom	NS	ND	ND	NS	0.028 U

May 1998 Containment

Notes:
1) All samples reported in ug/L
2) U = Less than detection limit
3) J = Estimated
4) The detection limit for carbon tetrachloride was 0.028 ug/L.

FIGURES

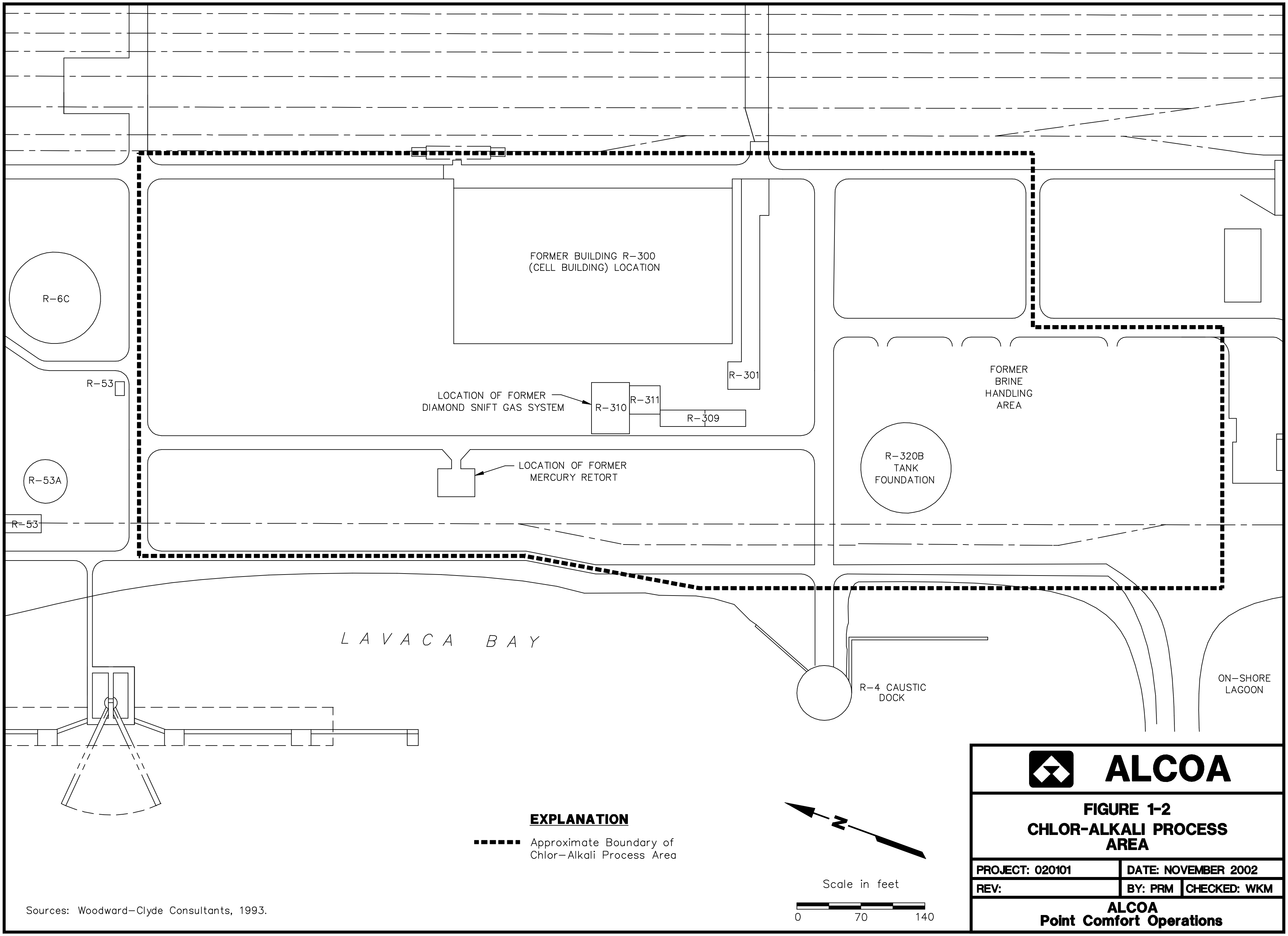


ALCOA

FIGURE 1-1
CHLOR-ALKALI PROCESS AREA
LOCATION MAP

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: ZGK CHECKED: KSM

ALCOA
Point Comfort Operations

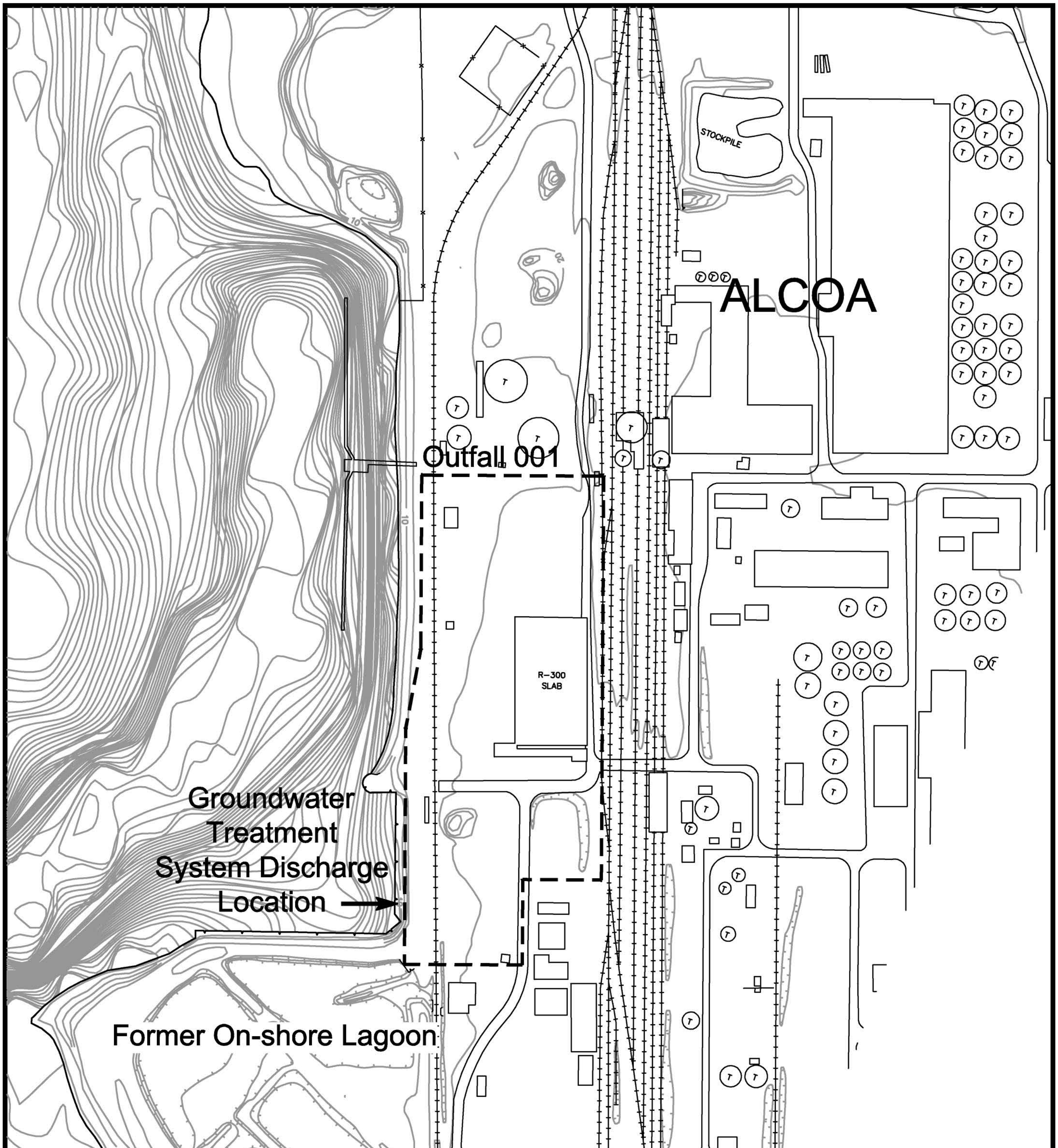


ALCOA

FIGURE 1-2
CHLOR-ALKALI PROCESS AREA

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: PRM CHECKED: WKM

ALCOA
Point Comfort Operations



ALCOA

FIGURE 1-3
CAPA SHORELINE BATHYMETRY

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: SK / CHECKED: SC

ALCOA
Point Comfort Operations

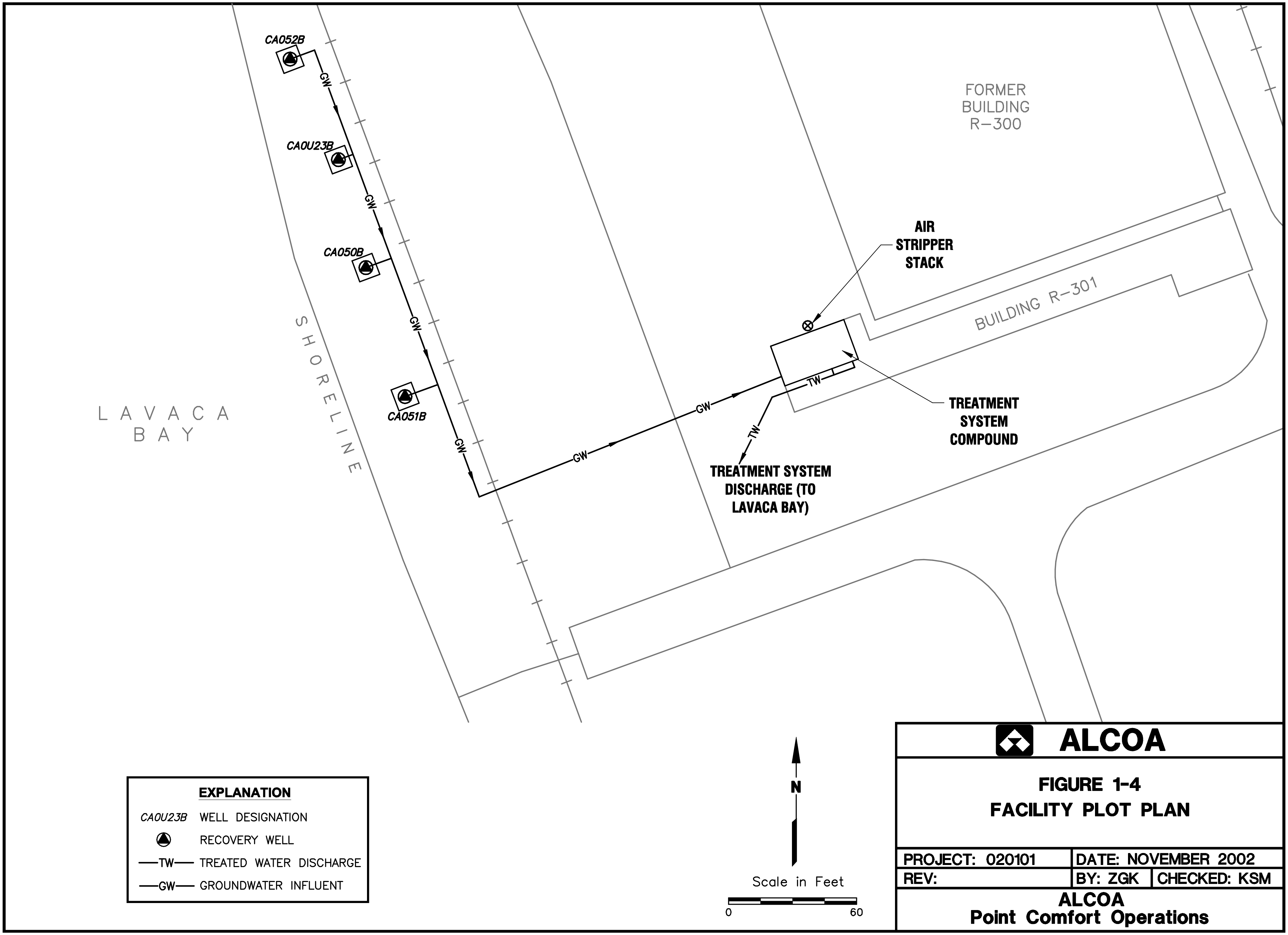
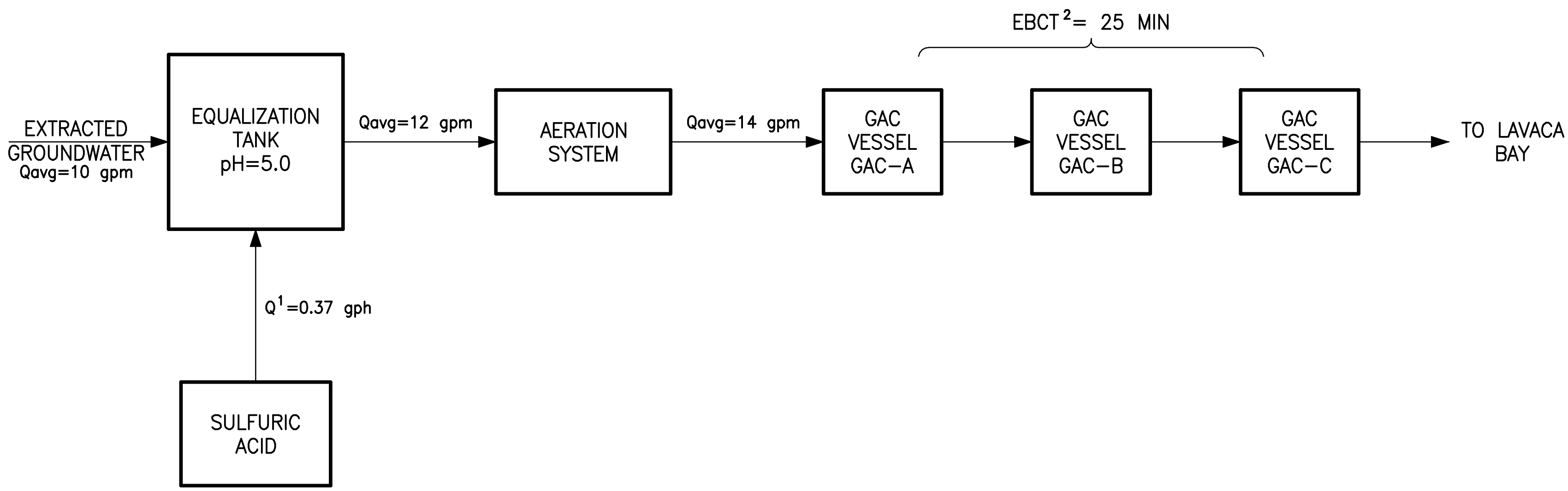


FIGURE 1-4
FACILITY PLOT PLAN

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: ZGK CHECKED: KSM

ALCOA
Point Comfort Operations



NOTES:

[1] 50% SULFURIC ACID (H_2SO_4)

[2] EBCT FOR EACH INDIVIDUAL VESSEL

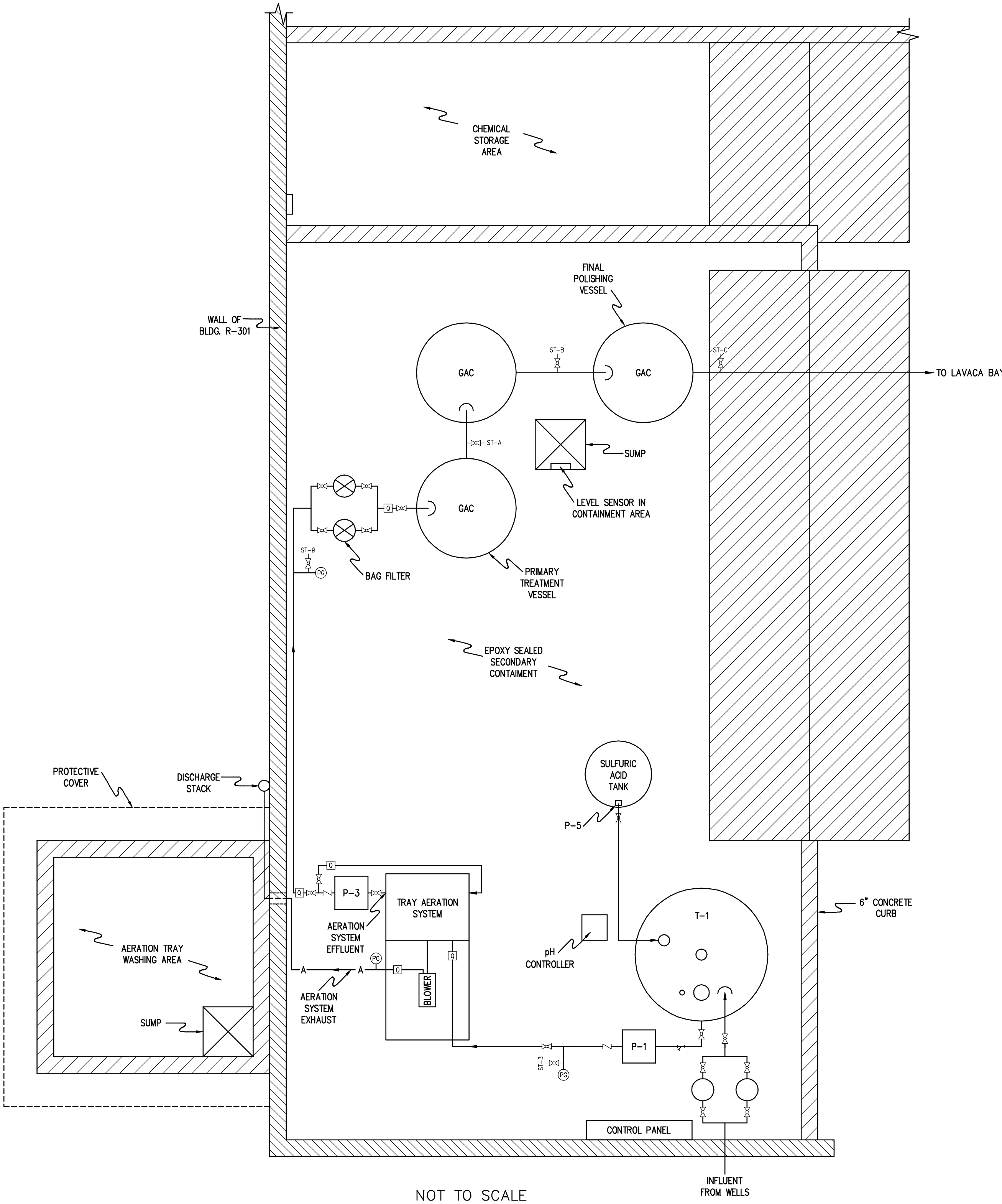
ALCOA

FIGURE 2-1

PROCESS FLOW DIAGRAM

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: ZGK / CHECKED: KSM

ALCOA
Point Comfort Operations



NOT TO SCALE

LEGEND

- CHECK VALVE
- BALL VALVE
- FLOW METER
- PRESSURE GAUGE
- SAMPLE TAP
- Y-STRAINER
- PIPING AND FLOW DIRECTION
- PUMP

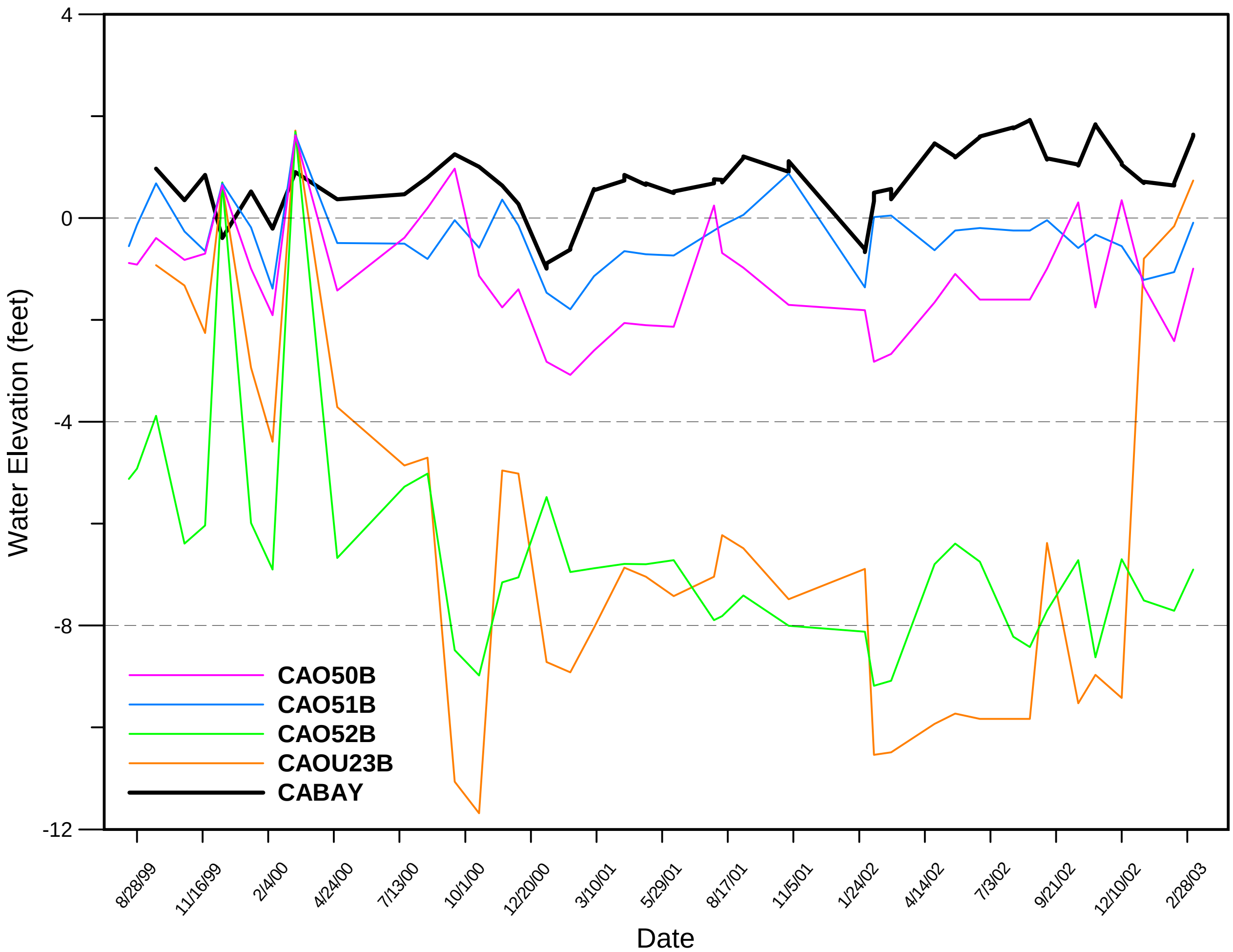
ALCOA

FIGURE 2-2

TREATMENT COMPOUND PLAN

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: ZGK / CHECKED: KSM

ALCOA
Point Comfort Operations

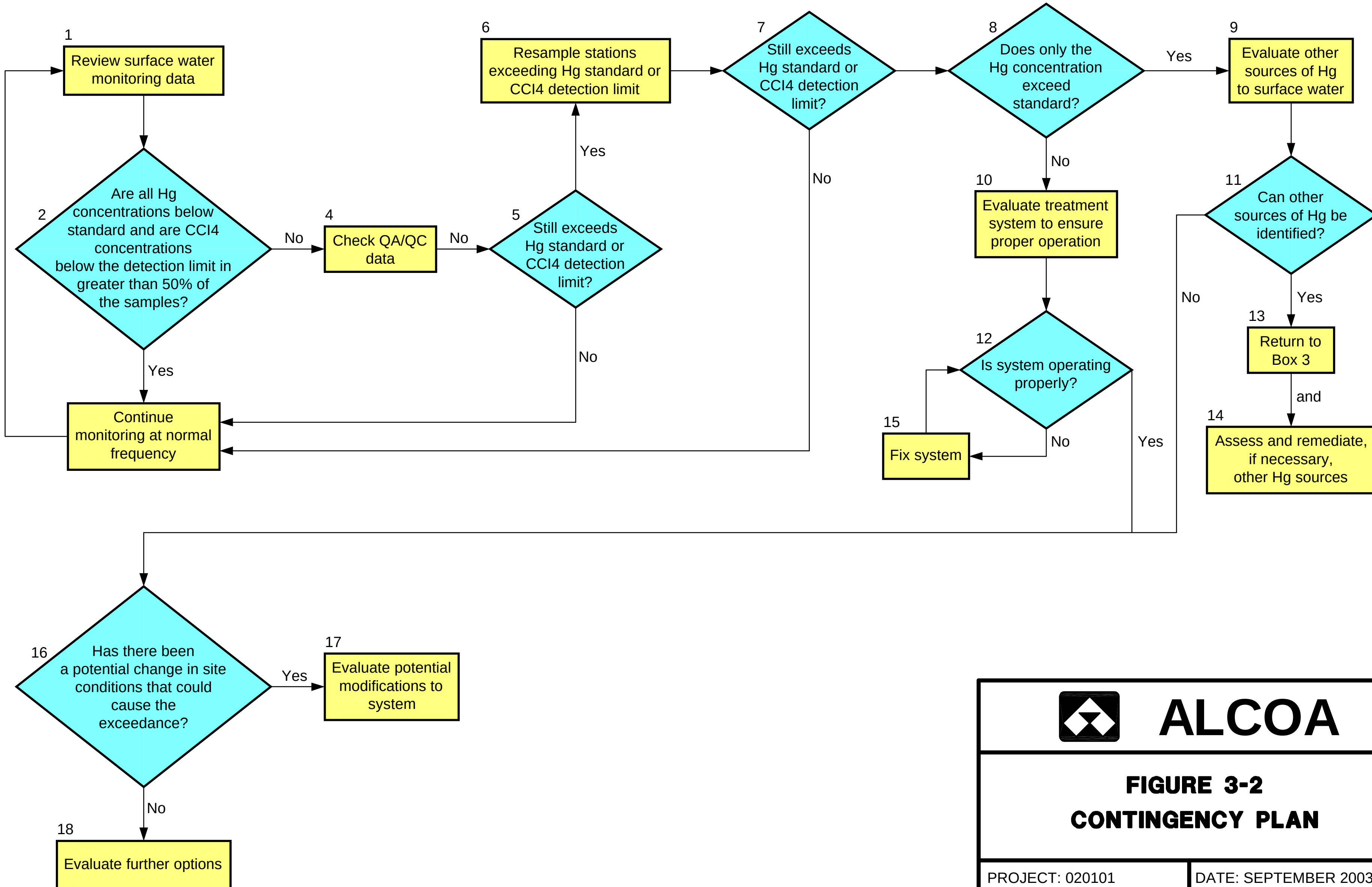


ALCOA

FIGURE 3-1
ZONE B HYDROGRAPHS AND LAVACA BAY LEVELS PUMPING WELLS

PROJECT: 024417	DATE: MAR., 2003	
REV:	BY: ZGK	CHECKED: CLM

ALCOA
Point Comfort Operations

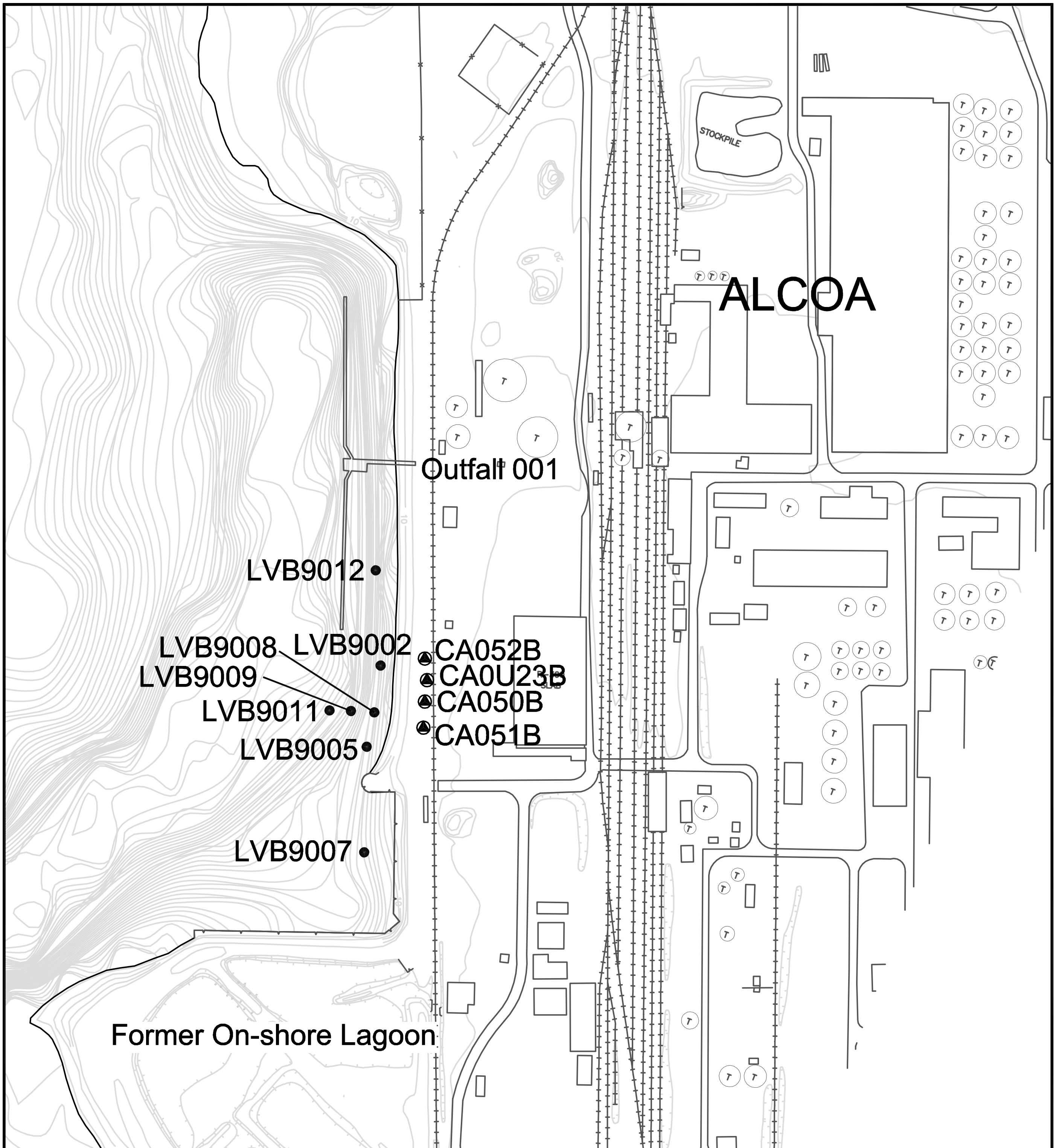


ALCOA

FIGURE 3-2
CONTINGENCY PLAN

PROJECT: 020101	DATE: SEPTEMBER 2003
REV:	BY: BWB CHECKED: MKW

ALCOA
Point Comfort Operations



EXPLANATION

- ● SURFACE WATER SAMPLING STATION
- ▲ RECOVERY WELL

Scale in Feet
0 350

N

ALCOA

FIGURE 3-3
CAPA OFFSHORE SURFACE WATER SAMPLING STATIONS

PROJECT: 020101	DATE: NOVEMBER 2002
REV:	BY: SK CHECKED: SC

ALCOA
Point Comfort Operations

APPENDIX A

GROUNDWATER TREATMENT SYSTEM OPERATION, MAINTENANCE STANDARD OPERATING PROCEDURE

GROUNDWATER TREATMENT SYSTEM OPERATION AND MAINTENANCE SOP

SYSTEM DESCRIPTION

The Chlor-Alkali Process Area (CAPA) groundwater treatment system is designed to reduce elevated carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene (PCE), and mercury concentrations in extracted groundwater to levels below site-specific surface water discharge standards. The treatment system consists of the following primary components:

- Four groundwater extraction wells equipped with aboveground jet pumps;
- One holding tank equipped with a mixer;
- Two sulfuric acid injection pumps and associated pH control system;
- One ORS LoProII low-profile air stripper;
- Three, 1,000 pound carbon vessels connected in series;
- Ancillary equipment such as pumps, bag filters, gauges, piping, etc.; and
- One programmable logic controller (PLC).

As shown on Figure 1-4 of the CAPA RDR, the majority of the treatment equipment is located within Building R-301. An aeration tray cleaning area is located outside of Building R-301, adjacent to the north side of the building. Overall system operation is controlled by the PLC which is located in a trailer located adjacent to the Building R-301 entrance.

Groundwater is extracted from the four extraction wells (CA0U23B, CA050B, CA051B, and CA052B) at an aggregate of eight to 10 gallons per minute (gpm). Approximately 2 gpm each is extracted from wells CA052B and CA0U23B while approximately 3 gpm is extracted from wells CA050B and CA052B. The difference in extraction rate is due to the hydraulic properties of the aquifer at each of the locations.

OPERATION AND MAINTENANCE ACTIVITIES

The following activities will be performed at least once a week during system operation:

(1) Upon arrival in Building R-301, measure ambient air mercury concentrations using a calibrated Jerome meter.

(2) If ambient air mercury concentrations are below action levels (see the Site Health and Safety Plan), continue to step (3). If ambient concentrations are above action levels, exit the building and notify the posted contact person.

(3) Review the system control panel and identify alarms, if any. In the event that an alarm condition has occurred or if the system does not appear to be functioning normally, immediately contact the specified contact person then record the date, time, and nature of the alarm.

(4) Visually inspect all equipment and piping for leaks. Check the treatment system containment area and the sump inside Building R-301 for accumulations of fluid and record the findings of the inspection.

(5) Record the following data from the treatment system:

- Air flow meter and pressure gauge readings from the air stripper;
- All other pressure gauge readings;
- All instantaneous flow rates either directly or by reading the total number of gallons measured at each totalizing flow meter in a one minute period;
- Total flow volumes from all totalizing flow meters; and
- Estimated sulfuric acid volumes.

(6) Record the following data from groundwater extraction wells:

- Pump status;
- Pressure gauge readings;
- Instantaneous flow rate (by reading the total number of gallons measured at the totalizing flow meter in a one minute period);
- Total flow volume from the totalizing flow meter;
- Alarm conditions, if any; and
- Leaks or presence of fluid in containment basin, if any.

PERIODIC MAINTENANCE ACTIVITIES

Note: The solids and water in the stripper and other treatment system components may contain elevated concentrations of mercury, carbon tetrachloride, chloroform, and/or

tetrachloroethene. Appropriate air monitoring and PPE should be worn during all maintenance activities (see the Site-Specific HSP).

Air Stripper Tray Cleaning. The air stripper trays may periodically become blocked by scale/solids during system operation. Blockage of the stripper trays will be indicated when the stripper air flow meter reading falls below 130 cfm or the stripper high/low air pressure alarms are activated. The procedures to be used to clean the stripper trays will be as follows:

- Deactivate system by turning the HOA switch of pump P-1 to “off” (see Figure 2-2 of the CAPA RDR);
- After 30 seconds, turn the HOA switches to the air stripper blower and pump P-3 to “off”;
- Turn breakers in the electric panel to “off” to ensure the system does not re-start.
- Remove the outer housing of each stripper tray in accordance with the manufacturer’s directions;
- Remove each stainless steel tray from its outer housing and carry the tray to the designated air stripper tray cleaning area outside of Building R-301 (See Figure 2-2 of the CAPA RDR);
- Clean the trays using water and dilute hydrochloric (muriatic) acid. A limited amount of physical cleaning using a wire brush may also be required. **Note: chlorine gas is released as a result of the reaction between the acid and calcium carbonate scale on the trays. Please take appropriate safety precautions (See Project-specific HASP);**
- The resultant sludges that collect in the sump will be allowed to dry, then shoveled into a 55-gallon drum and stored pending waste classification analyses;
- After cleaning, reinstall the trays and reassemble the air stripper according to the manufacturer’s directions;
- Restart the system by turning the system breaker to “on”, turning the HOA switch of pump P-3, the stripper blower, and pump P-1 to “auto” in that order. Remain on site for a minimum of 10 minutes after air stripper operation begins to ensure that the system is operating properly; and
- Record the date of the cleaning, approximate volume of solids removed and other pertinent data.

Bag Filter Cleaning. The bag filter units may periodically become blocked by scale/solids during system operation. Each bag filter unit consists of two filters, only one of which is in operation at any time to allow for continuous system operation during cleaning. Bag filter blockage will be indicated by an upstream pressure reading increase of greater than 5 psi above the initial upstream reading. The procedures to be used to clean the bag filters will be as follows:

- Divert flow to the second, clean filter by opening the appropriate control valves;
- Shut off flow to the filter to be cleaned by closing the appropriate control valves;
- Relieve the pressure in the bag filter housing by opening the appropriate relief port on the housing. Remove the housing cover to access the filter bag;
- Remove the spent bag from the housing and replace with a clean bag. Temporarily store the spent bag in its own sealed container (either 5-gallon bucket or 55-gallon drum) pending waste classification analyses;
- Replace the filter housing cover; and
- Record the date of the cleaning, approximate volume of solids removed and other pertinent data. Replace the filter housing cover.

Sulfuric Acid Replacement. Sulfuric acid is stored in large containers (totes) that are periodically refilled. The sulfuric acid will have to be periodically replaced as it is used in the system. The procedures to follow when replacing the sulfuric acid are as follows:

Note: Sulfuric acid is a hazardous, acidic material. Appropriate safety precautions should be taken when handling this material.

- When the sulfuric acid tote is approximately two-thirds empty, contact the sulfuric acid vendor to request a replacement tote.
- Don the appropriate PPE as indicated in the site-specific HASP, then turn off the power to each of the two sulfuric acid pumps.
- Open the new acid tote, then transfer the two acid pumps from the old tote to the new tote.
- Properly seal the old tote according to vendor instructions, then turn on power to one or both of the two pumps (depending on mode of operation).
- Contact acid vendor to arrange return of the used acid tote.

REPLACEMENT OF GRANULAR ACTIVATED CARBON VESSELS

The adsorption capacity of the GAC vessels will periodically become exhausted and the vessels will require replacement. The procedures for removing/replacing GAC vessels will be as follows (the procedures assume that there are three GAC vessels configured in series (identified, from

GROUNDWATER TREATMENT SYSTEM OPERATION AND MAINTENANCE SOP

upstream to downstream, as GAC-A, GAC-B, and GAC-C) and that GAC-A is the vessel being replaced):

(1) Record the total flow volumes from totalizing meters upstream and downstream of all GAC vessels.

(2) Turn off all equipment upstream of the GAC treatment train by turning the HOA switch to “off”.

(3) Shut off flow to GAC-A, then route the flow through GAC-B and GAC-C using the appropriate control valves.

(4) Drain all remaining water from GAC-A into the containment area sump. Turn on the sump pump to pump the water into the holding tank for retreatment in the system.

(5) Once all of the water has been drained from GAC-A, transfer the spent carbon to a “supersack” or other appropriate waste storage vessel. Temporarily store the spent carbon in the treatment compound pending waste classification analysis;

(6) Load the virgin carbon into the GAC-A vessel.

(7) Fill GAC-A will fresh water then let drain into the sump. Transfer the water from the sump to the holding tank using the sump pump.

(8) Place GAC-A back in line with the other two carbon vessels as the final polishing vessel in the series by opening the appropriate valves. GAC-B will then become the primary vessel with GAC-C becoming the second vessel. In other words, the carbon treatment vessel series will be in the following order: GAC-B, GAC-C, GAC-A.

(9) Record the date and time of GAC vessel replacement; and

(10) Re-start the treatment train by turning all HOA switches to “auto”.

GROUNDWATER TREATMENT SYSTEM OPERATION AND MAINTENANCE SOP

SYSTEM SAMPLING

Water quality samples will be collected from the treatment system in accordance with Section 3.0 of the CAPA RDR. In general, sampling procedures will be as follows:

(1) Identify the appropriate sampling locations for the analyses to be performed.

(2) Open the sample valve on the sampling tap slightly to allow a slow, continuous stream of liquid to be discharged from the sample tube.

(3) Purge the sample tube for approximately 5 seconds prior to initiating sample collection. Collect the purged water in a beaker or other container and deposit into tank T-1 at the system influent.

(4) Select the appropriate sample container for the analysis to be performed. Sample containers prepared specifically for the required analyses by the analytical laboratory will be used for sample collection.

(5) When analysis of dissolved metals is required and analyses will be performed at an off-site laboratory, field filtration of each sample will be performed using an in-line 0.45 micron filter or a 0.45 micron filter and filter press. The water sample will be filtered prior to transfer to the sample container and prior to preservation.

(6) Refer to the Sample Shipping SOP (RAD-SOP-007) for sample storage and shipping procedures.

(7) Field pH measurements will be made as soon as possible after collection of the sample, preferably within a few minutes. The value on the calibrated field instrument will be recorded after the reading has stabilized. If the reading falls outside the range for which the instrument has been calibrated, then the instrument will be recalibrated using the appropriate standards.

RECORDKEEPING

All data collected as part of system operation and maintenance, including PLC information, air and liquid pressure gauge and flow meter readings, maintenance activity descriptions, sample collection information, and general observations shall be recorded on the attached Groundwater Treatment System Monitoring Record form.

APPENDIX B

CAPA OFFSHORE SURFACE WATER MONITORING SAMPLING AND ANALYSIS PLAN

CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN

TABLE OF CONTENTS

CAPA OFFSHORE SURFACE WATER MONITORING SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) provides detailed procedures for collecting field samples to support the CAPA offshore surface water monitoring program.

The scope of work for this sampling program includes collecting water samples from three depths (surface, mid-depth, and bottom) in the water column at seven stations in Lavaca Bay, adjacent to the CAPA shoreline. In addition, one station will be sampled at the bottom depth every eight hours for an entire 24-hour period to evaluate the effects of tidal fluctuations at the site. All water samples will be analyzed for filtered mercury and carbon tetrachloride concentrations to monitor for potential CAPA groundwater releases. The remainder of this SAP provides details on the station locations, field and laboratory procedures, and quality assurance/quality control procedures to be employed.

CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN

2.0 SAMPLING AND ANALYSIS OBJECTIVES AND DESIGN

This section details the overall objectives and study design for the single-point sampling events and the 24-hour diurnal sampling events.

2.1 STUDY OBJECTIVES

The overall objective of the CAPA offshore surface water monitoring program is to monitor for indications of successful containment of contaminated groundwater by the CAPA extraction and treatment system. The treatment system is designed to remove groundwater upgradient of the shoreline, thus reducing lateral flow through the Zone B outcrop into the Bay. Successful containment of the CAPA groundwater will be indicated by dissolved mercury and carbon tetrachloride concentrations below surface water quality standards in the water column near the shoreline.

2.2 WATER COLUMN SAMPLING

Water samples will be collected from the surface, mid-depth, and bottom of the water column at seven locations adjacent to the CAPA shoreline (Figure 3-2 in the CAPA RDR) two times per year (once in the spring and once in the fall) for the two years, at which point the need for continued sampling will be evaluated. Samples will be analyzed for filtered mercury and carbon tetrachloride.

2.3 24-HOUR DIURNAL SAMPLING

Samples will be collected at one station (LVB9009) every eight hours for a 24-hour period to provide data for at least one complete tidal cycle. Station LVB9009 is located in the vicinity of the Zone B outcrop into the Bay and was shown during past investigations (See Section 3.2.3, Alcoa 1999) to be a reliable measure of groundwater flow into the Bay. Samples from the 24-hour monitoring event will also be analyzed for filtered mercury and unfiltered carbon tetrachloride.

CAPA OFFSHORE SURFACE WATER MONITORING SAMPLING AND ANALYSIS PLAN

3.0 FIELD PROCEDURES

3.1 SITE ACCESS

Site access will be gained by entering the Plant through the Contractor's Gate for the Point Comfort Operations facility. Most work will occur on a boat, which will be launched either at Alcoa's boat ramp (located next to the Bauxite offloading area) or at the City of Point Comfort's marina. Sample collection for the 24-hour diurnal sampling effort will occur by accessing the CAPA shoreline on foot.

3.2 STATION POSITIONING

All sample stations will be located using either a differentially corrected Global Positioning System (GPS) or by standard survey techniques. Sample station locations will match those used during previous investigations. Any deviations from the stated station positions will be documented in the field logbooks and annual report.

3.3 WATER COLUMN SAMPLING

Water column sampling will occur using the same procedures as with previous programs (Alcoa 1999). Once secured on station, samples will be collected using a peristaltic pump and Teflon hose. Water will be pumped from the desired depth directly into the sample container and immediately capped and placed into a cooler containing blue ice for delivery to the analytical laboratory. Filtered samples will be collected first by passing the water through a pre-cleaned in-line cartridge filter installed directly into the Teflon hose assembly. Once the filtered sample (mercury only) is collected, the filter is removed and the unfiltered samples (carbon tetrachloride) are then collected. In addition to samples collected for mercury and carbon tetrachloride analyses, field measurements for conductivity, salinity, temperature, and pH will be conducted at each station/depth sampled.

3.4 24-HOUR DIURNAL SAMPLING

Diurnal sampling will be conducted by mounting a Teflon hose in the field so that it extends from the estimated point of discharge for the Zone B aquifer (located along the bottom slope at Station LVB9009) at a point just above the sediment surface to the shoreline.

3.5 SAMPLE IDENTIFICATION, HANDLING, PRESERVATION AND SHIPPING

Upon collection, all samples will be immediately stored on ice (or blue ice), in a cooler. Sample containers will be labeled with the following information:

- Project name and number
- Sample type and identification number
- Date sampled
- Type of preservative (if any)
- Initials of field personnel
- Analysis required

All sample containers will be pre-labeled, except for the date, time, and initials of the field staff. This information will be written on the label immediately prior to placing the sample in the containers.

At the end of each day's sampling, chain-of-custody (COC) forms will be filled out by the field crew leader, or their designee. Chain-of-Custody information will include the following:

- Name and phone number of the designation laboratory

- Project identification
- Matrix of all samples
- Number of containers
- Sample identification numbers, dates, and times of sample collection
- Analysis required
- Field personnel collecting the samples
- Name of person recording the COC information
- Quality control/sample transport notes
- Signatures of persons relinquishing control of the samples with dates and times

Upon shipment or delivery to the laboratory, the number, types, preservatives, and labeling of the samples will be verified by the persons relinquishing and receiving the samples. Both persons will sign and date the COC forms and retain copies.

3.6 FIELD NOTES AND OBSERVATIONS

In addition to the site entry and health and safety logs, the following daily field notes will be recorded:

- Date and names of sampling personnel
- Time when each sample is collected
- Sample identification and DGPS location coordinates
- Details of sampling effort and any deviations from the standard procedures
- Pertinent field observations (wave height, wind speed and direction, etc.)

**CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN**

4.0 LABORATORY ANALYSES

The following laboratory procedures will be used to conduct the mercury and carbon tetrachloride analyses.

4.1 MERCURY

Water column samples will be analyzed for filtered mercury according to EPA Method 1631. Detection limits are typically in the range of 5 ng/L (ppt), though 0.05 to 0.2 ng/L (parts per trillion) can be achieved using this method.

4.2 CARBON TETRACHLORIDE

Water column samples will be analyzed for total carbon tetrachloride by the laboratory using either method number SW846 8260B (GC/MS) or 8021B (GC).

**CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN**

5.0 QUALITY ASSURANCE/QUALITY CONTROL

5.1 FIELD QA/QC PROCEDURES

Field QA/QC procedures will include the use of equipment blanks (also called rinsate blanks) and bottle blanks. Equipment blanks are used to verify that the sampling equipment has been properly decontaminated. These samples are collected by rinsing the equipment with mercury-free deionized water and analyzing the water using standard analytical procedures. Bottle blanks are used to verify that the sample bottles have been properly decontaminated and are collected by rinsing a random set of bottles with mercury-free deionized water and analyzing the water using standard analytical procedures. Field QA/QC samples will be collected at a frequency of one for every 20 samples collected, or one per sampling day.

5.2 LABORATORY QA/QC PROCEDURES

Laboratory QA/QC procedures will include the use of laboratory duplicates and matrix/matrix spike duplicates (MS/MSD). Laboratory duplicates are used to test analytical variability; MS/MSDs are used to test analytical recovery. Laboratory QA/QC test frequencies and acceptable performance criteria are the same as for the CAPA Focused Investigation (see QAP in Alcoa, 1997b).

5.3 DECONTAMINATION PROCEDURES

For equipment used to collect and store samples not designated for low-level mercury analyses, the following decontamination procedure will be followed:

- Scrub with hot water and soap (e.g., Alconox)
- Rinse 5 times with tap water
- Soak in 10% acid (HNO_3) bath

- Rinse 5 times with tap water
- Rinse with acetone
- Rinse 10 times with tap water
- Rinse 5 times with deionized water

Following decontamination, all equipment should be wrapped in aluminum foil and placed inside plastic bags until the next use. Sufficient quantities of sampling equipment will be obtained such that they will be used only once in the field, then decontaminated using the above procedures while on shore at the end of each day.

When ultra-low detection levels are desired for the mercury analyses, extreme care will be taken to prevent sample contamination during all phases of the sample collection and handling process. Specific guidelines exist for collecting environmental samples with very low metal concentrations (see EPA, 1995), and these will be stringently followed. For sample containers used to store and transport samples to the analytical laboratory and any materials that will be in frequent contact with samples containing very low mercury concentrations, a hot acid wash will occur prior to entering the field. The sample containers with then be filled with a dilute acid solution until used for sample storage.

5.4 MANAGEMENT OF INVESTIGATION DERIVED WASTE

The field activities described in this SAP will generate various types of investigation-derived wastes (IDW). Proper disposal of the IDW will be implemented by Alcoa.

5.5 HEALTH AND SAFETY PROCEDURES

Task-specific health and safety procedures have been identified for this RDR and are detailed below. These procedures are described solely as a supplement to the CAPA HASP.

**CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN**

Specific tasks that may not be adequately covered by the project Safety and Health Plan include (1) SCUBA diving near the active shipping channel adjacent to the Alcoa CAPA shoreline; and (2) working at night under low-light conditions.

SCUBA diving activities for this project include entering the water near the CAPA shoreline and descending to a depth of approximately 15-20 feet. Once at the proper depth, a flexible hose will be mounted to the sediment surface and extended to the shoreline to allow periodic collection of water during the diurnal sampling portion of the study. Special safety precautions will include the following:

- Coordinating all activities with Alcoa staff to implement the field work during times of minimal vessel traffic;
- Using a “diver-down” flag to signify that a diver is in the water;
- Maneuvering around the site carefully to prevent potentially contaminated sediment from being re-suspended into the water column; and
- Ensuring that at least one additional field employee is present to observe surface conditions (e.g., vessels entering the area) at all times while the diver is under water.

Nighttime working conditions will be required during implementation of the diurnal sampling program. These activities will be limited to the collection of water samples along the CAPA shoreline using a peristaltic pump. The following precautionary measures will be taken to ensure these activities are performed in a safe manner:

- All employees will carry flashlights to provide sufficient working light; and
- Reflective tape or clothing will be worn to ensure all staff are visible to plant vehicles at night.

**CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN**

6.0 DATA MANAGEMENT AND REPORTING

Field data recorded on the log sheets will be entered into electronic format and also transferred to the centralized database. Laboratory data will be transferred to the centralized database after appropriate formatting.

An annual monitoring report will be prepared to present the results of the CAPA off-shore surface water monitoring study (as well as the results of the annual monitoring, as described in the RDR), which will include, at a minimum, the following:

- Descriptions of all sampling and monitoring procedures;
- Types of sampling and monitoring equipment used;
- Protocols used during sampling, monitoring and testing, and an explanation of any deviations from the approved protocols;
- Methods used to locate and positions of all sampling locations;
- Copies of COC forms, field logsheets, and other notes relevant to the monitoring program;
- Results of the laboratory analyses (tabulated in summary tables and copies of raw lab data);
- QA/QC procedures and data;
- Maps containing a summary of the data;
- Interpretation of the current results and a comparison to previous data; and
- Any proposed modifications to future monitoring events.

**CAPA OFFSHORE SURFACE WATER MONITORING
SAMPLING AND ANALYSIS PLAN**

7.0 REFERENCES

Alcoa, 1995. RI Workplan for the Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume D: General Site Specific Safety and Health Plan. November 3.

Alcoa, 1999. Remedial Investigation Report: Alcoa (Point Comfort)/Lavaca Bay Superfund Site. November.

CAPA OFFSHORE SURFACE WATER MONITORING SAMPLING AND ANALYSIS PLAN

STANDARD OPERATING PROCEDURES

The following Standard Operating Procedures will be used to implement this RDR. All have been approved by EPA and used during previous investigations at the site. Any deviations to these protocols will be noted in the annual data reports.

SOP-PMX-SL-5	*Station positioning using differential global positioning system*
SOP-PMX-SMP-5B	*Conducting water sampling using a peristaltic pump*
SOP-PMX-SMP-7A	*Sample shipment and freezing procedures*
SOP-PMX-SMP-8A	*Telephone verification of sample receipt*
SOP-FG-AN-1A	*Cleaning of sample equipment and bottles for collection of mercury samples*
Specification PSEP	*Total suspended solids*
SOP-PMX-FM-1	*Salinity – calibration and use of refractometer*
SOP-PMX-FM-2	*Temperature – calibration and use of thermometer*
SOP-PMX-FM-4	*pH – calibration and routine measurements in water and sediment*
SOP-PMX-DR-1	*Recording field data on field data sheets*
SOP-PMX-DR-2A	*Departures, deviations and amendments to the protocol, SAP or SOPs*
SOP-PMX-DR-6A	*Abbreviations interpretation and use*
SOP-PMX-QU-3A	*Sample labeling and COC requirements*
SOP-PMX-MC-3A	*Cleaning for reuse of sample containers and gear that comes into direct contact with samples*

UPDATE TO CHLOR-ALKALI PROCESS AREA SOILS REMEDIAL DESIGN REPORT AND OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix D to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Remedial Design Report (RDR) and Operations, Maintenance, and Monitoring Plan (OMMP) for Chlor-Alkali Process Area (CAPA) soils from September 2003.[1] Maintenance and monitoring of the CAPA soil cap are conducted in accordance with the original RDR and OMMP. Periodic inspections will occur semi-annually and also on an as-requested or as-needed basis.

[1] Alcoa, 2003. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.

Chlor-Alkali Process Area Soils

Remedial Design Report and

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

September 2003

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document represents the Remedial Design Report (RDR) and associated Operations, Monitoring, and Maintenance Plan (OMMP) for the Chlor-Alkali Process Area (CAPA) soil remedy at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site in Point Comfort, Texas. Soils with a mercury concentration greater than 466 mg/Kg were capped as described in the Feasibility Study (FS) (Alcoa, 2000). This document presents an overview of the soil remedy, the objectives of the remedial and monitoring program, and other considerations. This RDR/OMMP is one of a series of RDRs and OMMPs that collectively provide the design for the entire Site remedy as defined in the Record of Decision (ROD) (EPA, 2001). These reports have been prepared as attachments to the Consent Decree.

1.2 SITE DESCRIPTION

The Site is defined in the Administrative Order on Consent (AOC) and in the Project Management Plan (PMP) (Alcoa, 1996). Specifically, the area covered by this RDR is the CAPA, located on the western portion of the PCO facility near the Lavaca Bay shoreline (Figures 1-1 and 1-2). The CAPA encompasses that area of the plant where sodium hydroxide was produced from 1966 to 1979 for use in the bauxite refining process. Mercury cathodes were used in the electrolytic conversion of sodium chloride to sodium hydroxide, chlorine gas, and hydrogen. The chlorine gas was removed from the gas stream using carbon tetrachloride. Over time, releases of mercury and carbon tetrachloride occurred in the subsurface at the CAPA. A detailed description of the historical operations at the CAPA is contained in the *Preliminary Site Characterization Report* (PSCR) (Alcoa, 1995). Contaminated soils in the immediate vicinity of Building R-300 at the CAPA were identified during the RI as having mercury concentrations above the risk-based value (RBV) of 466 mg/Kg (Alcoa, 1999a).

1.3 REMEDY OVERVIEW

Since the soil samples with mercury concentrations exceeding the RBV were generally associated with process features such as mercury collection trenches, sumps, and foundation joints, the identified area for this response action (shown as the shaded area on Figure 1-3) was developed to encompass these features. The area addressed by the remedial action objective (RAO) includes the entire Building R-300 footprint and extends approximately 75 feet to the west and five feet to the north of the building foundation (or approximately 1.8 acres). This area was capped (as described in Section 2.0) as part of plant operations as allowed under Paragraph 59 of the AOC.

In the FS, remedial action alternatives to address the CAPA soil RAO were evaluated. Based on the results of that analysis, the recommended remedy for CAPA soil was capping. No additional construction, therefore, is necessary. Information related to design and construction of the cap is contained in Section 2.0. Maintenance of the cap is described in Section 3.0 of this report.

1.4 PERFORMANCE OBJECTIVES AND STANDARDS

On the basis of the conclusions of the CAPA Focused Investigation (Alcoa, 1998a) and the BLRA (Alcoa, 1999b), the general RAO for CAPA soils is to reduce the future exposure potential of site workers (e.g., construction worker, general industrial worker, and maintenance worker) to mercury in soils in the Building R-300 vicinity. As noted in Section 2.3.1 of the FS, CERCLA guidance recommends including both an exposure pathway and a contaminant level in the RAO. For CAPA soils, the RAO exposure pathways are incidental ingestion of, and dermal contact with, soil. The mercury concentration for soils to be addressed by the RAO is 466 mg/Kg. The RAO for CAPA soils does not include reducing the potential for ongoing leaching of mercury from these soils to underlying groundwater, since control of CAPA groundwater discharge to the bay will be performed as part of the bay remedial action alternatives.

The performance objective for the CAPA soil remedy (protective cap and security devices) is to limit worker exposure to site soils by restricting worker access to the area and implementing a site-specific Health and Safety program for the area.

1.5 PLAN REVIEW AND REVISION

At the end of each calendar year, Alcoa will review the effectiveness of the OMMP in meeting the monitoring objectives. At that time, changes, which may include additions or deletions to the scope of the program, will be proposed for Agency review in an effort to better meet the objectives of the OMMP. Upon Agency acceptance, the changes will be incorporated into the OMMP for the remainder of the monitoring period, or until further changes are deemed necessary.

The procedures presented in this OMMP are based on methods that have been successful at other similar locations. Future site conditions and/or changes in technology may necessitate modifications to these procedures. Any permanent changes or temporary deviations will be documented and reported to the Agencies in a timely manner. If possible, these changes will be reported to the Agencies prior to implementation unless required in the field.

2.0 REMEDIAL DESIGN

As stated above, a gravel cap was installed at the former CAPA under Paragraph 59 of the AOC. The primary component of the cap consists of six inches of gravel. To achieve proper storm water drainage from the restricted area, the protective cap was designed with a one-percent slope and the storm water management structures (inlets and drain lines) were modified to collect only surface runoff. The centerline of the ridge (high point) for the cap coincides with the former east/west centerline of Building R-300. The one-percent slope was obtained by placing and compacting a clay subgrade over the entire area, from approximately several inches thick at the perimeter to 1.2 feet thick at the center. A six-inch crushed limestone material was then placed and compacted over the clay subgrade. Four storm drain inlets receive runoff from the capped area. The inlets were part of the existing storm water collection system that drains to the On-Shore Lagoon, only the inlet elevations were modified to tie into the new grade created by the protective cap.

To limit usage of the area by Plant and contractor personnel, three feet by six feet warning signs were placed on the north and west sides of the capped area (Figure 1-3). Additionally, a memo was distributed plantwide to inform workers of the upgrades made to the area, the restrictions on the capped portion of CAPA, and disciplinary actions as a result of not complying with restrictions (Appendix A).

3.0 OPERATION, MAINTENANCE, AND MONITORING

The capped area will be inspected on a quarterly basis. The area will be inspected for:

- Cap integrity (e.g., signs of vehicular traffic or erosion);
- Vegetation growth;
- Signage integrity (e.g., upright and legible);
- Storm drains free of debris; and
- No equipment or waste storage.

Any items that are noted during the inspection will be addressed as soon as practicable. For example, ruts form vehicular traffic or erosion will be filled with crushed limestone and weed growth will be controlled by the application of herbicide. In addition, Alcoa will require that the management memo describing the prohibition of activities on the site be reviewed by Plant personnel and contractors on an annual basis.

4.0 ADDITIONAL OPERATIONS, MAINTENANCE, AND MONITORING CONSIDERATIONS

4.1 SCHEDULE

Inspections of the capped area have been conducted during the interim period between installation of the cap and the submittal of this document. Formal monitoring of the capped area will be initiated within one month after the Consent Decree has been filed and will be repeated on a quarterly basis thereafter.

4.2 HEALTH AND SAFETY AND MONITORING

A Health and Safety Plan (HSP) addressing maintenance of the capped area has been prepared and will be maintained on site at all times.

4.3 REPORTING REQUIREMENTS

The monitoring information collected as part of this OMMP will be reported to the regulatory agencies on an annual basis in the form of an annual monitoring report.

5.0 REFERENCES

Alcoa, 1995. *Preliminary Site Characterization Report for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1996. *Project Management Plan for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1999a. *Remedial Investigation Report Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* November.

———, 1999b. *Baseline Risk Assessment Report Alcoa (Point Comfort)/Lavaca Bay Superfund Site.*

———, 2000. *Feasibility Study Alcoa (Point Comfort)/Lavaca Bay Superfund Site.*

United States Environmental Protection Agency (EPA), 2001. Record of Decision Alcoa (Point Comfort)/Lavaca Bay Superfund Site. December.

FIGURES

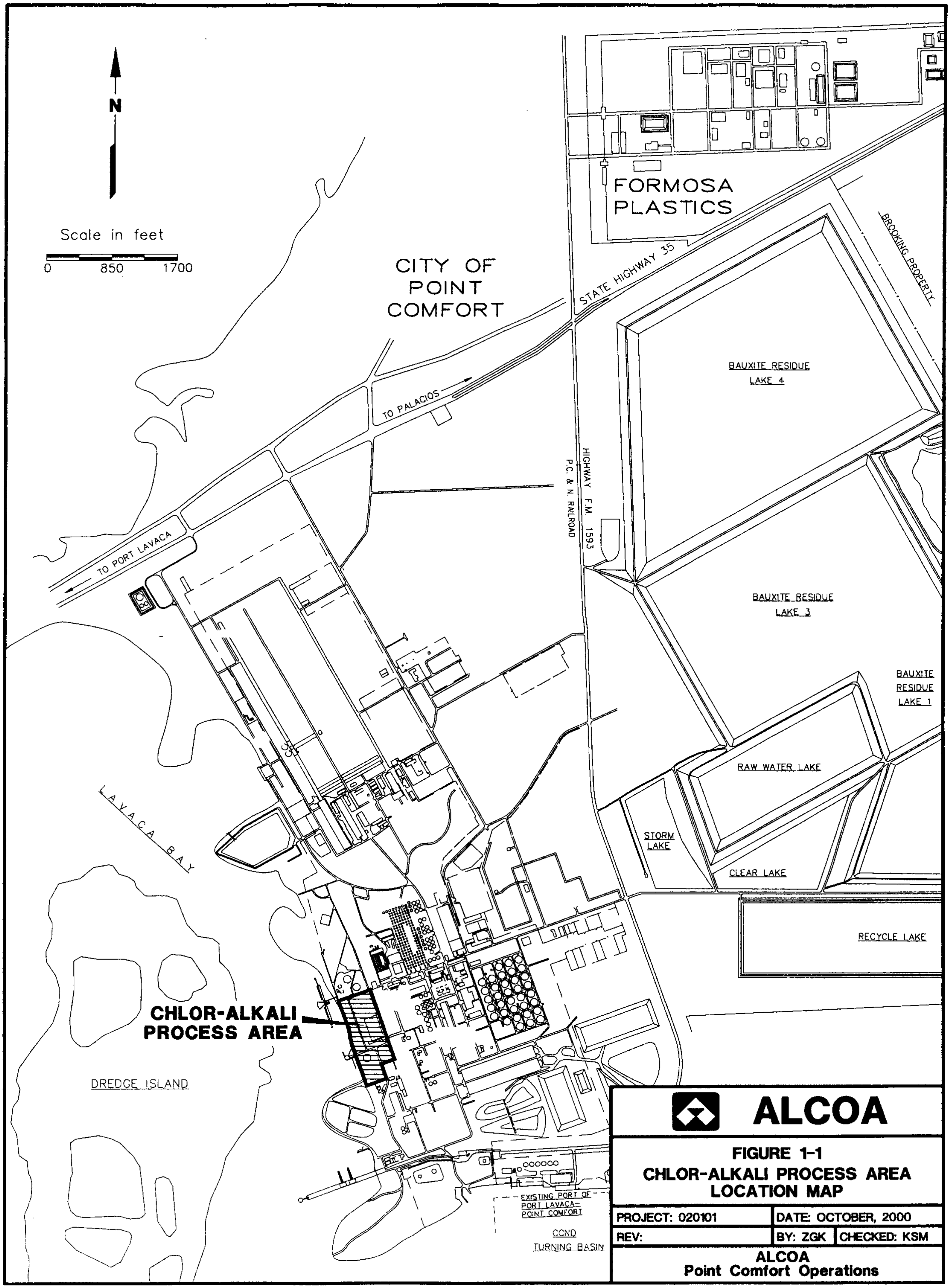
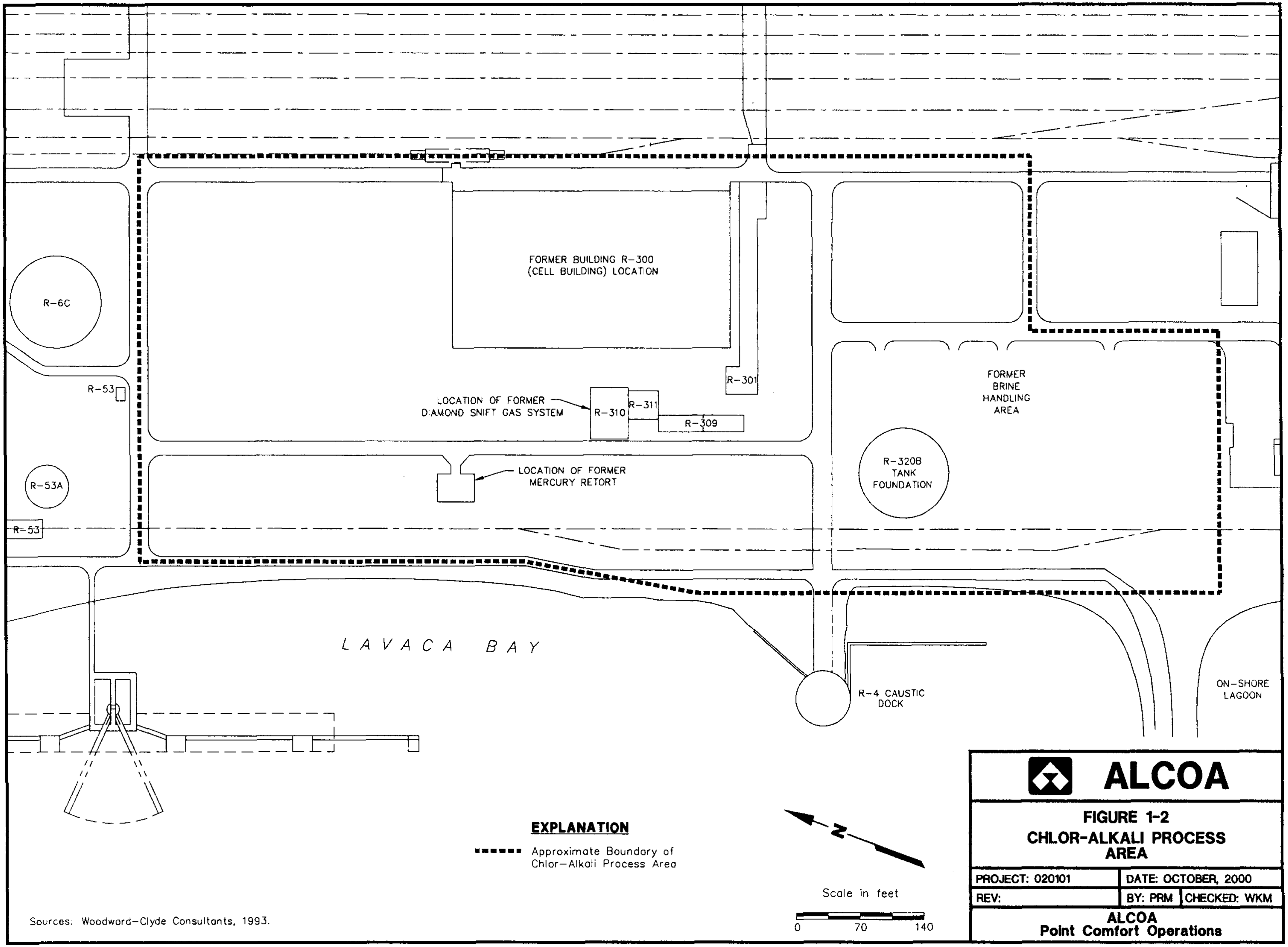


FIGURE 1-1
CHLOR-ALKALI PROCESS AREA LOCATION MAP

PROJECT: 020101	DATE: OCTOBER, 2000	
REV:	BY: ZGK	CHECKED: KSM

ALCOA
Point Comfort Operations



ALCOA

FIGURE 1-2
CHLOR-ALKALI PROCESS AREA

PROJECT: 020101	DATE: OCTOBER, 2000
REV:	BY: PRM	CHECKED: WKM

ALCOA
Point Comfort Operations

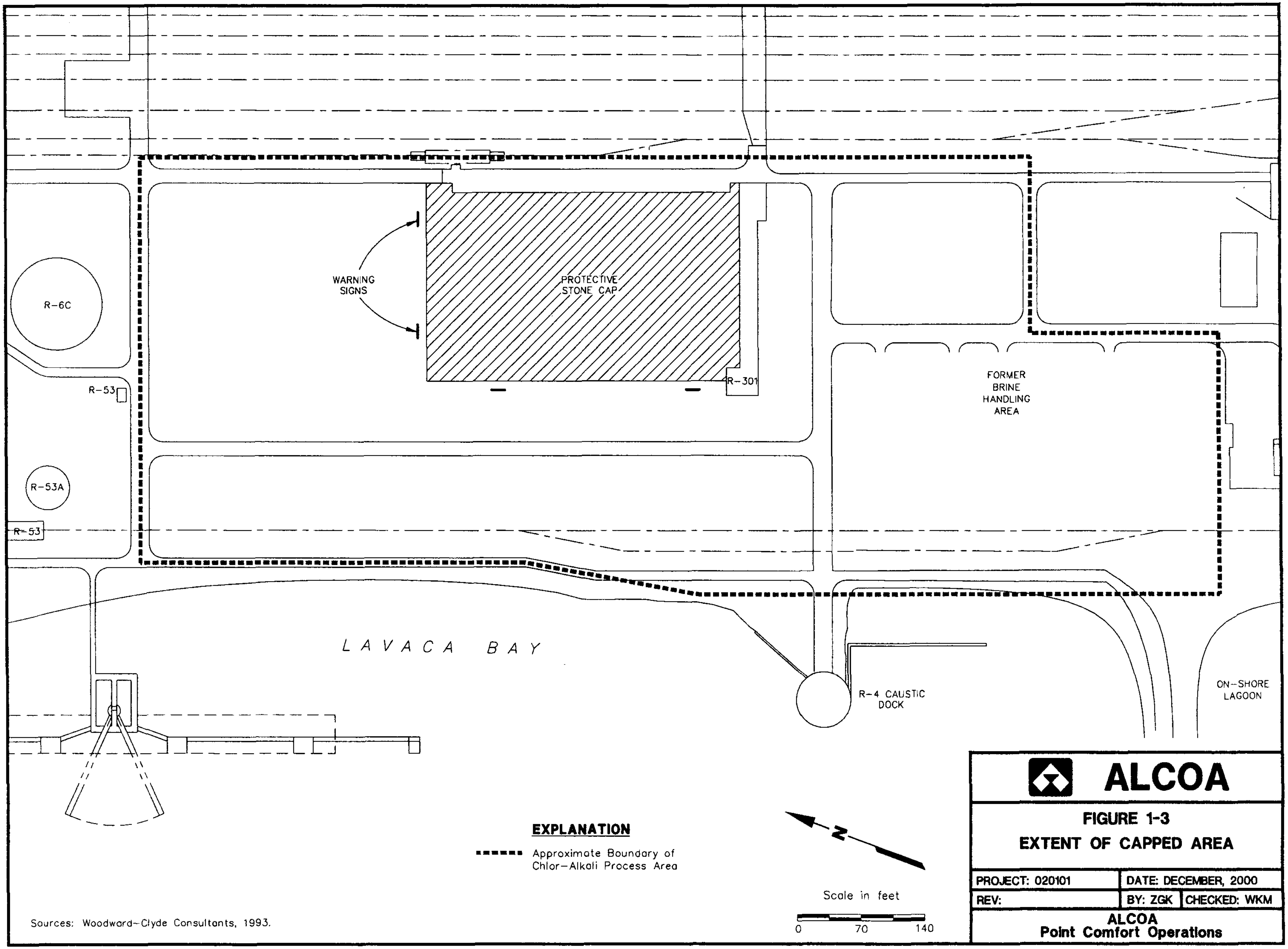


FIGURE 1-3
EXTENT OF CAPPED AREA

PROJECT: 020101	DATE: DECEMBER, 2000
REV:	BY: ZGK CHECKED: WKM

ALCOA
Point Comfort Operations

APPENDIX A

SIGNAGE AND MEMORANDUM

CLOSED AREA

(Former Chlor-Alkali Facility)

DO NOT: DIG, DRILL, STORE EQUIPMENT OR MATERIALS,OR OTHERWISE DISTURB AREA WITHOUT PROPER AUTHORIZATION

MANAGEMENT MEMO

2000 MAY 19

As part of Alcoa's Superfund Remediation Plan, the former Chlor-Alkali Process Area was remediated by removing the R-300 building, covering the surrounding mercury contaminated soils with clean clay and a six inch layer of crushed limestone, and the remainder of the process area graded and seeded. The limestone-capped area is intended to be permanent and the area restricted. The restricted area must be maintained in its current state. In addition to the work completed by the R-300 building, Calhoun Road was widened to allow two way traffic.

Recently several vehicles have cut across the limestone cap and made deep ruts in the cap. These ruts have been repaired. The restricted area is subject to inspection by government agencies. This type of damage to the limestone cap could result in other request of Alcoa in the restricted area, such as installing an expensive 6' chain link fence around the perimeter of the restricted area.

The Remediation Work Group spent a considerable amount of money to improve Calhoun Road. There is no need to drive across the capped area to travel through this part of the plant. Driving across this restricted area without authorization is considered a serious offense that is subject to severe discipline up to and including dismissal.

Please adhere to signs around this area to warn people to stay off the limestone cap. The signs states:

"CLOSED AREA
DO NOT DIG, DRILL, STORE EQUIPMENT
OR MATERIALS, OR OTHERWISE DISTURB AREA
WITHOUT PROPER AUTHORIZATION"

JOHN E. VASQUEZ
PERSONNEL-PUBLIC RELATIONS MANAGER

UPDATE TO FORMER WITCO TANK FARM DNAPL CONTAINMENT SYSTEM REMEDIAL DESIGN REPORT AND OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix E1 to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Remedial Design Report (RDR) and Operations, Maintenance, and Monitoring Plan (OMMP) for the Witco Tank Farm Area from September 2003.[1] Maintenance and monitoring of the Former Witco Tank Farm remedial actions are conducted in accordance with the original RDR and OMMP. Periodic inspections will occur semi-annually and also on an as-requested or as-needed basis.

[1] Alcoa, 2003. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.

Former Witco Tank Farm DNAPL Containment System

Remedial Design Report and

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

September 2003

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document represents the Remedial Design Report (RDR) and associated Operations, Monitoring and Maintenance Plan (OMMP) for the former Witco Tank Farm Area Dense Non-aqueous Phase Liquid (DNAPL) Containment System at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site in Point Comfort, Texas. Containment of DNAPL containing polyaromatic hydrocarbons (PAHs) at the former Tank Farm Area is a component of the Bay System remedy, as described in the Feasibility Study (FS) (Alcoa, 2001) and required by the Record of Decision (ROD) (EPA, 2001). Note that the remedial design for the Witco Area described in this document differs from the conceptual design described in the FS. This change is due to the findings of the pre-design investigation, as described in the following sections. This document presents an overview of the containment system, the design objectives of the program, and other program considerations. This RDR is one of a series of RDRs and OMMPs which collectively provide the remedial design for the entire Site as defined in the ROD. These reports have been prepared as attachments to the Consent Decree.

1.2 SITE DESCRIPTION

The Site is defined in the Consent Decree. Specifically, the area covered by this RDR is the former Witco Tank Farm Area and vicinity, located on the western portion of the PCO facility near the shoreline with Lavaca Bay (Figure 1-1). DNAPL and/or visibly PAH-contaminated sediment was observed at several locations near the former Witco Coal Tar Tank Farm Area during the RI (Alcoa, 1999 and Appendix A). The DNAPL distribution, in concert with the configuration of relatively permeable layers (fill) overlying capillary barriers (Beaumont clay), indicated that the DNAPL may migrate along the fill layer base toward Lavaca Bay. And, if this were to occur, the DNAPL potentially would be subject to dissolution and/or partitioning to Bay sediment.

The area of DNAPL or visibly-contaminated soil was approximated based on the RI data, and the evaluation of remedial alternatives was developed for the FS. The remedial alternative discussed in the FS consists of a sheet-pile containment wall and collection trench, and a preliminary estimate of the wall location and extent was developed. A more detailed design of the containment wall was to be completed after additional data were collected during the proposed pre-design investigation.

Pre-design investigations for the DNAPL containment system were performed during February 2001, and resulted in revisions to the conceptual model of DNAPL presence and movement at the site, as discussed in the following sections. Consequently, the remedial design proposed in this RDR differs from that in the FS.

The original scope of the pre-design investigation was outlined in a letter from Alcoa to EPA dated February 1, 2001. The investigation was to include the following six components:

- DNAPL delineation;
- Waste characterization;
- Slope stability analysis;
- Evaluation of Zone B depth;
- DNAPL mobility evaluation; and
- Wetlands evaluation.

The scope of work was modified during the investigation based on field observations and findings. Each of the six investigation components is described in the following sections.

DNAPL DELINEATION

The February 1, 2001 letter proposed the drilling of 10 borings, primarily to further define the presence of DNAPL in the subsurface. The 10 proposed borings were drilled using a hollow-stem auger drilling method or hand auger. Twenty additional borings were advanced using a hand auger. The locations of the RI and pre-design investigation borings are shown on Figure 1-2. The lithologic logs for the pre-design investigation borings are included in Appendix A.

In conjunction with this work, a temporary access road was constructed west of the former Tank Farm to provide access to the drilling locations proposed for the shoreline area, and silt fencing was installed along the edge of the grass flats at the bay shoreline. However, due to marshy conditions, the locations along the shoreline area could not be accessed by the drilling rig and these locations were probed using a hand auger. Due to the technical limitations of hand augering in the hard clays of the Beaumont Formation, the proposed depths for the shoreline borings (top of Zone B, if no DNAPL encountered) could not be reached. .

The drilling portion of the pre-design investigation indicated that DNAPL was present over a much smaller, more localized area than initially believed, with the lateral extent of DNAPL generally limited to the near vicinity of the former Tank Farm area (Figure 1-2). Also, observations of DNAPL at the site indicate that the material is not highly fluid or continuous, but typically occurs in small droplets (“blebs”) of oily material or as a sheen on the free water observed in the soil/sediment during sampling. The specific areas in the former Tank Farm vicinity where DNAPL, droplets of DNAPL, or an oily sheen has been observed include boring locations MW-4, MW-6a, MW-6c, MW-6e, MW-6f, W-7, W-8, MW-9, WPD-4, WPD-16 and WPD-22. Also, stained soil/DNAPL has been observed within the drainage ditch southwest of the former Tank Farm Area (previously referred to as the “seep area”).

Based on the spatial distribution of DNAPL-impacted soils in the vicinity of the former Coal Tar Tank Farm (Figure 1-3), it appears that a discrete, continuous DNAPL fluid layer is not present nor has it migrated along the fill layer/Unit II as discussed in the FS. Rather, the DNAPL is limited in volume and is distributed unevenly throughout the subsurface in the vicinity of the tank farm. Based on these characteristics, it appears that small amounts of DNAPL (originally products such as creosote, coal tar, or pitch) were likely spilled, placed or relocated there during and after the time the Witco facility was in operation. There are several mechanisms that could have resulted in the occurrence of DNAPL at the observed locations:

1) DNAPL could have been spilled or disposed over the edge of the former Tank Farm western berm, prior to placement of the fill west of the tank farm (possibly relates to all observed DNAPL locations);

2) DNAPL-containing fill/wastes could have been relocated/moved as the area was developed/reconfigured as Site operations evolved; and/or

3) Storm water discharges through the drainage culvert south of the former Tank Farm could have deposited and/or carried DNAPL-containing materials to their current locations (related to the DNAPL-impacted area at the drainage ditch area and the WPD-4/WPD-16/WPD-22 locations).

The remedial action objective will still address the potential migration of DNAPL to Lavaca Bay, but over a smaller area.

WASTE CHARACTERIZATION

The February 2001 letter proposed the collection of three samples of DNAPL-impacted material (two samples from the shoreline borings, and one sample from the upland borings, assuming DNAPL was identified). Since little DNAPL or DNAPL-impacted material was observed during the investigation, only one sample was collected (at boring WPD-4c, see boring log in Appendix A). The sample was analyzed for moisture content, Toxicity Characteristic Leaching Procedure (TCLP) semi-volatiles, TCLP metals, total cyanide and total petroleum hydrocarbons. The analytical data are included in Appendix B. These data, and possible other data to be collected during implementation of the remedy, will be used to evaluate disposal options for any excavated material.

SLOPE STABILITY ANALYSIS

The February 2001 letter proposed the collection of multiple samples of various strata for geotechnical testing. The geotechnical testing data were to be used to conduct a slope stability analysis of the existing fill slope, since it was thought that heavy equipment would need to be staged along the slope during remedy construction (barrier wall installation). The pre-design investigation data indicated that a smaller area of DNAPL existed than previously thought and, therefore, the extent of the DNAPL containment system would be limited. The slope stability analysis was therefore considered unnecessary. However, a limited amount of geotechnical data were collected to evaluate the bulk geotechnical properties of the subsurface materials that may be encountered during remedy construction. These data are provided in Appendix C.

ZONE B DEPTH

The February 2001 letter proposed that the depth to the top of Zone B would be evaluated in the four shoreline borings. Field conditions did not permit access to the shoreline area with the drilling rig, and the top of Zone B could not be reached using the hand auger since the clays were too dense. The top of Zone B would have likely been encountered at approximately 10 feet land surface along the shoreline, and the deepest penetration with the hand auger was approximately 8 feet below land surface (Appendix A).

Existing data on the depth to the top of Zone B from previous investigations is sufficient to allow for design of the proposed slurry wall, as data from upland borings were extrapolated toward the shoreline.

DNAPL MOBILITY EVALUATION

A DNAPL mobility evaluation was proposed for the pre-design investigation. Based on previous observations at MW-6a, a DNAPL monitoring well to be installed in the vicinity of MW-6a. Two borings (WPD-5 and WPD-6) (Appendix A) were drilled on either side of MW-6a during the pre-design investigation. DNAPL or DNAPL-impacted soil was not detected in either boring, and therefore, no DNAPL monitoring well was installed. The data from these borings were important to the revision of the conceptual model of DNAPL presence and migration since they indicated that there was not a continuous layer of DNAPL between the former tank farm and MW-6a area, and between MW-6c and MW-6a.

Please refer to the Witco Area Groundwater Investigation Phase 1 and 2 Report (Alcoa, 2000) for information related to the existing DNAPL monitoring well (MW-9).

WETLANDS EVALUATION

The area along the shoreline at the former tank farm was surveyed for the presence of wetland plant species. This survey indicated that wetland plant species are present along the shoreline. The results of the survey are provided in Appendix D. Future construction in these areas will consider the presence of wetland species and the possible need for a USACE 404 permit if wetlands may be disturbed.

1.3 REMEDY OVERVIEW

Containment of PAH-containing DNAPL in the former Tank Farm area is a component of the Bay System remedy, which also includes enhanced natural recovery of the area north of Dredge Island, dredging/filling of the Witco Marsh, dredging of the Witco Channel, stabilization of the Dredge Island, hydraulic control of groundwater at the Chlor-Alkali Process Area (CAPA), and removal of bay sediments offshore of the CAPA. This component of the remedy effectively controls and eliminates a potential ongoing source of PAH recontamination to Lavaca Bay by excavating “hot spots” where DNAPL was observed in shallow sediments adjacent to the bay and by constructing a vertical containment barrier between the bay and the areas in the former Tank Farm area where DNAPL was encountered.

1.4 PERFORMANCE OBJECTIVES AND STANDARDS

The overall remedial action objective (RAO) for the former Tank Farm area is to reduce the potential for migration of PAH-containing DNAPL to Lavaca Bay and remove DNAPL/PAH-contaminated soil/sediments that could be re-distributed to Bay sediment. The key performance objectives for the remedy include the following:

1) Construction of a vertical barrier to prevent DNAPL migration from the area south of the former Tank Farm area in the vicinity of borings MW-6e, MW-6f, MW-9 and W-7;

2) Construction of a DNAPL collection sump in the area behind (northeast of) the vertical barrier to allow possible collection of DNAPL that may accumulate in this area following barrier construction;

3) Excavation of sediments containing visible DNAPL from the areas immediately adjacent to Lavaca Bay in the vicinity of boring WPD-4; and/or

4) Excavation of soils containing visible DNAPL in the vicinity of the drainage ditch (SE7 on Figure 1-2) and reconstruction of the drainage ditch in the vicinity.

Although a DNAPL collection sump is included in the proposed remedy, neither the RAO nor the remedy design objectives include the goal of maximizing DNAPL collection. Rather, the collection sump is included in the remedy as a mechanism for monitoring whether DNAPL accumulates behind the vertical barrier and, if needed, provides a mechanism for sampling and analysis of the accumulated DNAPL. Objectives and procedures for inspection and monitoring of the DNAPL collection sump are described in Section 3.0 of this report.

1.5 PLAN REVIEW AND REVISION

At the end of each calendar year, Alcoa will review the effectiveness of the remedy and the monitoring program in meeting the performance objectives. At that time changes, that may include additions or deletions to the scope of the program, will be proposed for Agency review in an effort to better meet the remedy objectives. Upon Agency acceptance, the changes will be incorporated into the monitoring procedures for the remainder of the monitoring period, or until further changes are deemed necessary.

2.0 REMEDIAL DESIGN

As described previously, the four key components of the DNAPL containment remedy are: (1) construction of a vertical barrier; (2) construction of a DNAPL collection sump; (3); excavation of DNAPL-containing sediments near the bay shoreline; and (4) excavation of DNAPL-containing soils in the vicinity of the drainage ditch. Key design parameters associated with each of these components are discussed in detail below. The temporary access road constructed as part of pre-design investigations will be used to allow construction equipment access to the vertical barrier location. Following remedial construction activities the slope will be revegetated to reduce erosion potential. The silt fencing installed during the pre-design investigation will be maintained throughout construction activities.

2.1 DNAPL-CONTAINING SEDIMENT EXCAVATION

DNAPL, droplets of oily material or an oily sheen were observed in four shallow borings (WPD-4, WPD-14, WPD-16 and WPD-22) near the bay shoreline west of the former Tank Farm. The DNAPL observed in this area appears very localized and limited to a shallow depth (the maximum depth of DNAPL occurrence was 2.7 feet in boring WPD-16). Sediments containing visible DNAPL will be excavated from this area, with the lateral and vertical extent of excavation defined by the visible observation of DNAPL (i.e., verification sampling and analysis will not be performed). Based on the pre-design investigation data, the total in-situ volume of sediments to be excavated from this area is approximately 20 cubic yards. Excavated sediments will be stockpiled for sampling and analysis. Analytical results will be used to establish the waste classification of the sediments. Disposal will be in an on-site facility, if appropriate based on the waste classification; otherwise, sediments will be disposed of off-site in a landfill appropriate for the waste type.

2.2 DNAPL-CONTAINING SOIL EXCAVATION

As described in the RI report (Alcoa, 1999), DNAPL-contaminated material was observed in the drainage ditch southwest of the former Tank Farm Area (Figure 1-2). Soils that contain visible

DNAPL or are visibly contaminated with PAHs will be excavated from this area, with the lateral and vertical extent of excavation defined by visible observations (i.e., verification sampling and analysis will not be performed) and the feasibility of excavation (i.e., excavation will not be performed if the integrity of the slope to the north of the drainage ditch is threatened). Based on field observations, the in-situ volume of soils that may be excavated from this area is anticipated to be on the order of 20 cubic yards. Excavated soils will be stockpiled for sampling and analysis. Analytical results will be used to establish the waste classification of the soils. Disposal will be in an on-site facility, if appropriate, based on the waste classification; otherwise, soils will be disposed of off-site in a landfill appropriate for the waste type.

2.3 VERTICAL BARRIER CONSTRUCTION

The vertical barrier at the Witco Area will be located near the end of the existing surface water drainage ditch located southwest of the former Tank Farm Area where DNAPL was observed in the subsurface (Figure 1-3). The vertical barrier will consist of a conventionally constructed (i.e., surface excavation) slurry wall. The slurry wall will be relatively shallow in depth (approximately 10 feet), approximately 100 feet long, and will be keyed into the high plasticity (CH) clay (Unit II; Beaumont Clay) below the fill and bay sediment (Figure 2-1). It is anticipated that a temporary coffer dam will be constructed in the ditch downstream from the proposed barrier location to allow dewatering of the ditch during slurry wall construction. In conjunction with the barrier construction and excavation of soils around the drainage ditch area, the drainage ditch located south of the former Tank Farm area will be reconstructed with clean imported fill material and lined with gunite to the point of discharge into the bay and thus reduce erosion in the area (Figure 2-1).

2.4 DNAPL COLLECTION SUMP CONSTRUCTION

During vertical barrier construction activities, a DNAPL collection sump will be constructed immediately northeast of the vertical barrier. The sump will serve as a monitoring location to evaluate potential DNAPL accumulation behind the barrier. The proposed approximate location of this sump is shown on Figure 1-3; the final sump location will be selected based on field conditions observed during barrier construction. The collection sump will consist of a large-diameter (4-inch diameter or greater) slotted pipe placed to the top of the CH clay described above. The area around the pipe will be backfilled with gravel or similar high permeability material following pipe placement. The pipe will be completed above final grade and will be fitted with a locking enclosure. Monitoring of the sump for DNAPL accumulation and removal of DNAPL will be performed as described in Section 3.2 of this RDR.

2.5 HEALTH AND SAFETY AND AIR MONITORING

A Health and Safety Plan (HSP) will be prepared prior to the initiation of remediation activities. This plan will cover DNAPL-containing sediment and soil excavation, vertical barrier and collection sump installation, and maintenance/monitoring of the containment system. The HSP will provide procedures for monitoring of ambient organic vapors during construction activities and will describe engineering controls and/or contingency plans to be used in the event that monitoring criteria are exceeded.

2.6 REPORTING REQUIREMENTS

Remedial construction activities will be documented in a Construction Completion Report. This report will include a description of the remedial activities, field records, and as-built drawings. The report will note any design or field changes and will include all sediment/soil analytical data and disposal information. Any modifications or additional details for the containment system maintenance and monitoring procedures described in this RDR will also be presented. The Construction Completion Report will be signed and sealed by a Texas-registered Professional Engineer.

2.7 FINAL DESIGN AND OTHER WORK REQUIRED

Final design plans and specifications for the remedial action proposed in this RDR will be prepared and included in the Remedial Action Workplan. Construction specifications, with quality control requirements, will be prepared in general accordance with standard Construction Specifications Institute (CSI) format. These technical construction specifications with QA/QC will be included with instruction to bidders and other documents required for construction contract bidding.

3.0 MAINTENANCE AND MONITORING

3.1 CONTAINMENT SYSTEM INSPECTION AND MAINTENANCE

The reconstructed section of the drainage ditch southwest of the former Tank Farm Area will be inspected on a quarterly basis during the initial two years following construction. After the initial two years following construction, the inspections will be conducted on an annual basis. Specifically, the gunite lining will be inspected for signs of cracking or settlement and the adjacent slopes will be examined for evidence of erosion. Cracks in the gunite liner and erosion damage will be repaired as needed.

3.2 DNAPL COLLECTION SUMP MONITORING

For the first six months following construction, the DNAPL collection sump will be inspected on a monthly basis. The thickness of accumulated water and/or DNAPL within the sump (if any) will be measured with an electronic indicator or transparent bailer. In addition, the total depth of the sump will be sounded to assess potential sediment accumulation at the base of the sump. Also during this initial six-month period, DNAPL that accumulates in the sump will be removed. Inspections and DNAPL removal will be completed on the collection sump on a quarterly basis between six months and two years following construction, and will be completed on an annual basis after two years following construction. If significant accumulations of DNAPL are observed, the inspections/removal may occur more frequently.

3.3 REPORTING REQUIREMENTS

The DNAPL collection sump field measurements, along with observations regarding the ditch and slope conditions will be reported to the regulatory agencies at the end of the first year of the monitoring period in the form of an annual monitoring report. The ongoing need for this annual report will be re-evaluated based on the DNAPL accumulation measurements.

4.0 REFERENCES

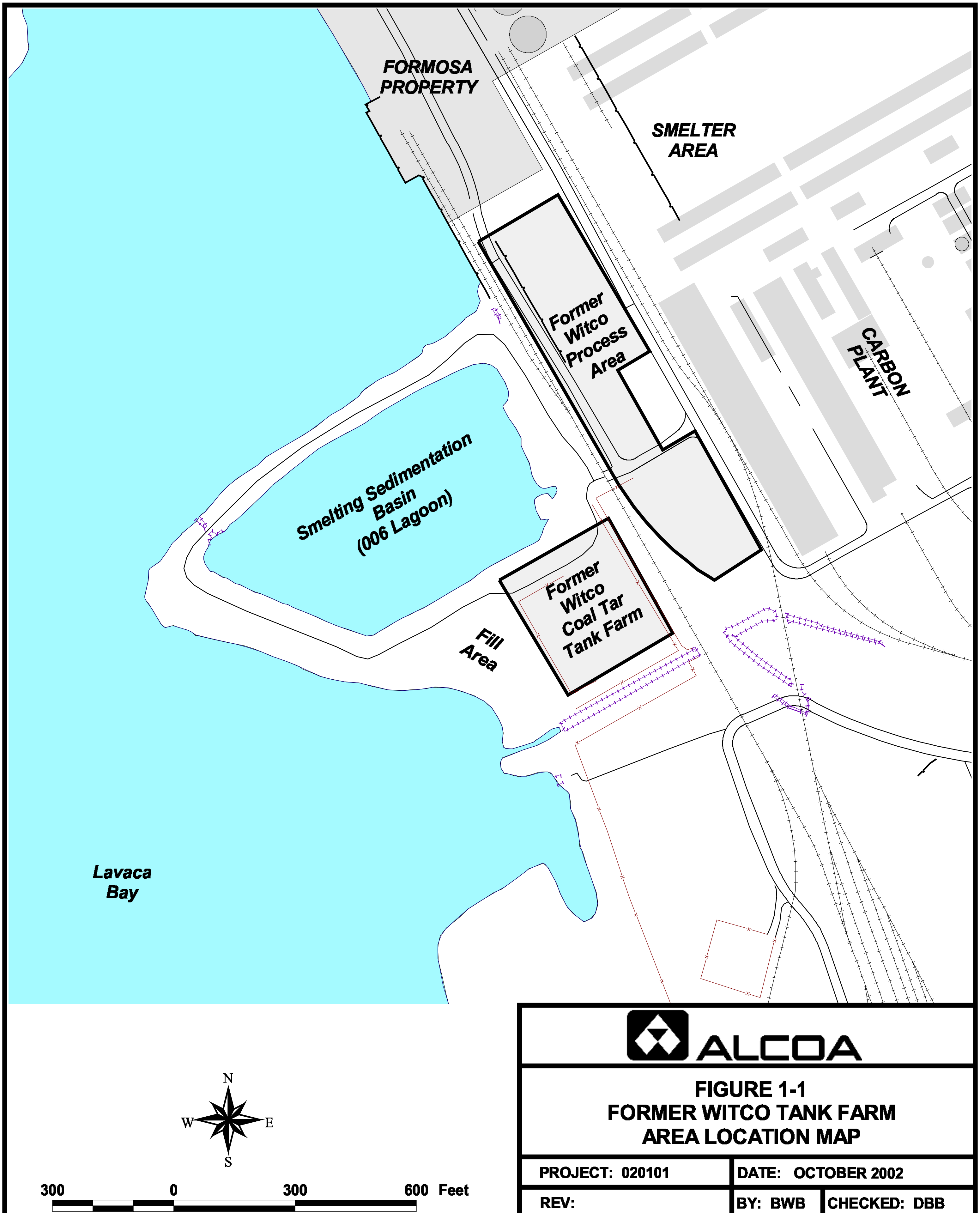
Alcoa, 1996. *Project Management Plan for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1999. *Remedial Investigation Report Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* November.

———, 2001. *Feasibility Study Alcoa (Point Comfort)/Lavaca Bay Superfund Site.*

United States Environmental Protection Agency (EPA), 2001. Record of Decision Alcoa (Point Comfort)/Lavaca Bay Superfund Site. December.

FIGURES

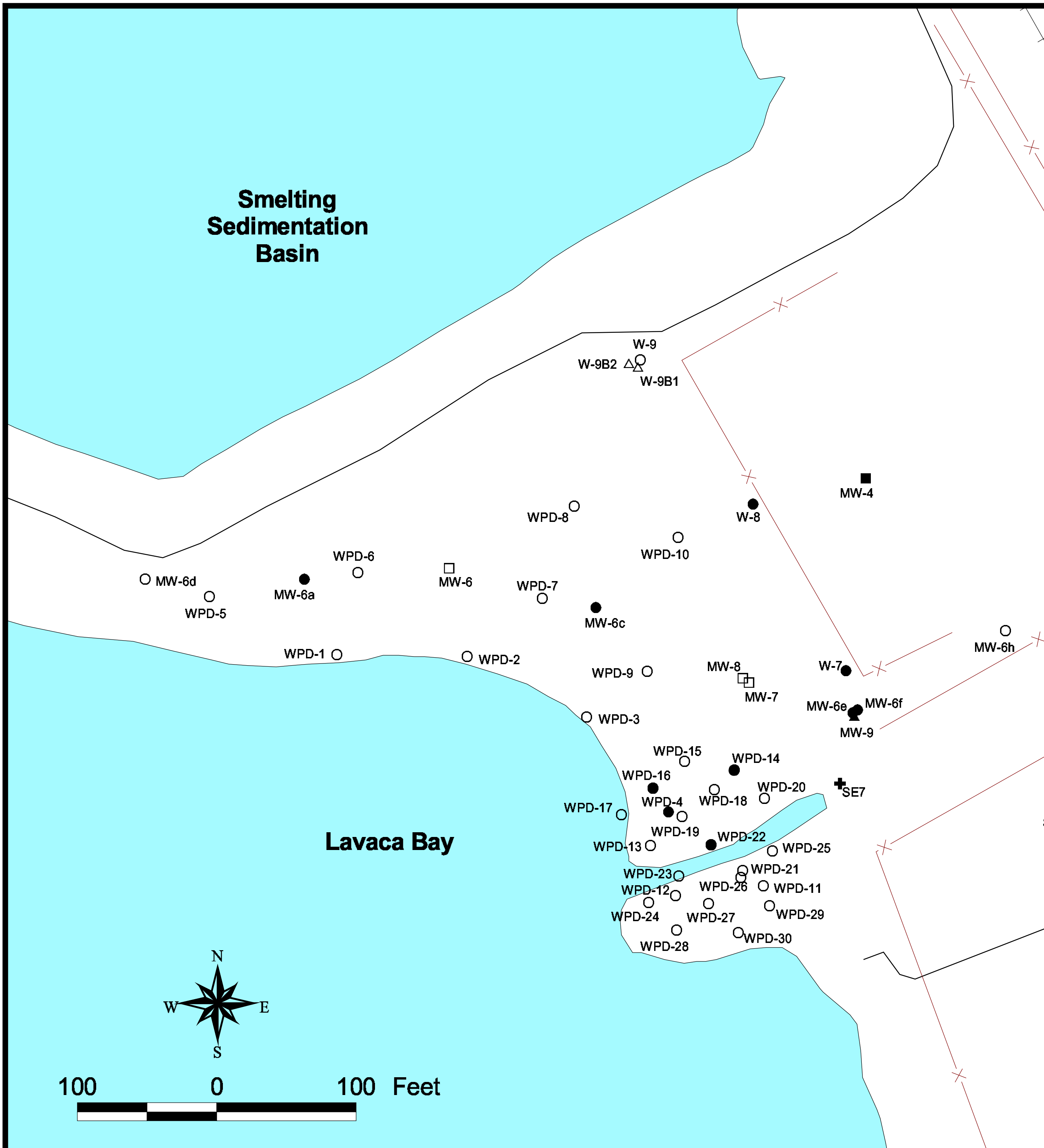


ALCOA

FIGURE 1-1
FORMER WITCO TANK FARM AREA LOCATION MAP

PROJECT: 020101	DATE: OCTOBER 2002
REV:	BY: BWB / CHECKED: DBB

ALCOA
Point Comfort Operations



EXPLANATION

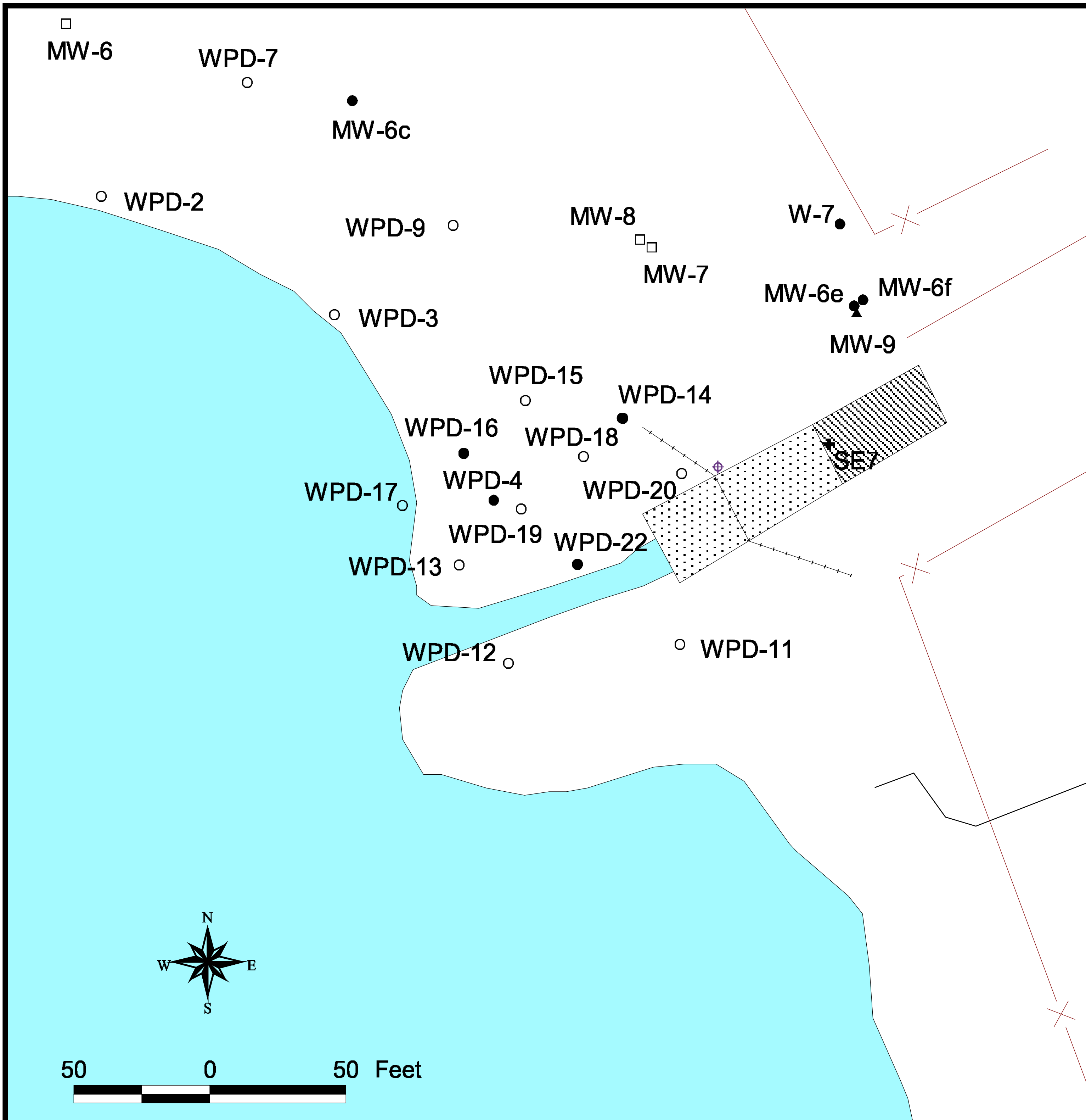
- Monitoring Well With DNAPL
- Recovery Well With Apparent DNAPL
- Soil Boring With Apparent DNAPL
- Stained Soil/DNAPL Area in Drainage Ditch
- Monitoring Well Without Apparent DNAPL
- Soil Boring Without Apparent DNAPL
- Temporary Well Without Apparent DNAPL

ALCOA

FIGURE 1-2
FORMER WITCO TANK FARM
AREA INVESTIGATION LOCATIONS

PROJECT: 020101	DATE: JULY 2003	
REV:	BY: BWB	CHECKED: MKW

ALCOA
Point Comfort Operations



EXPLANATION

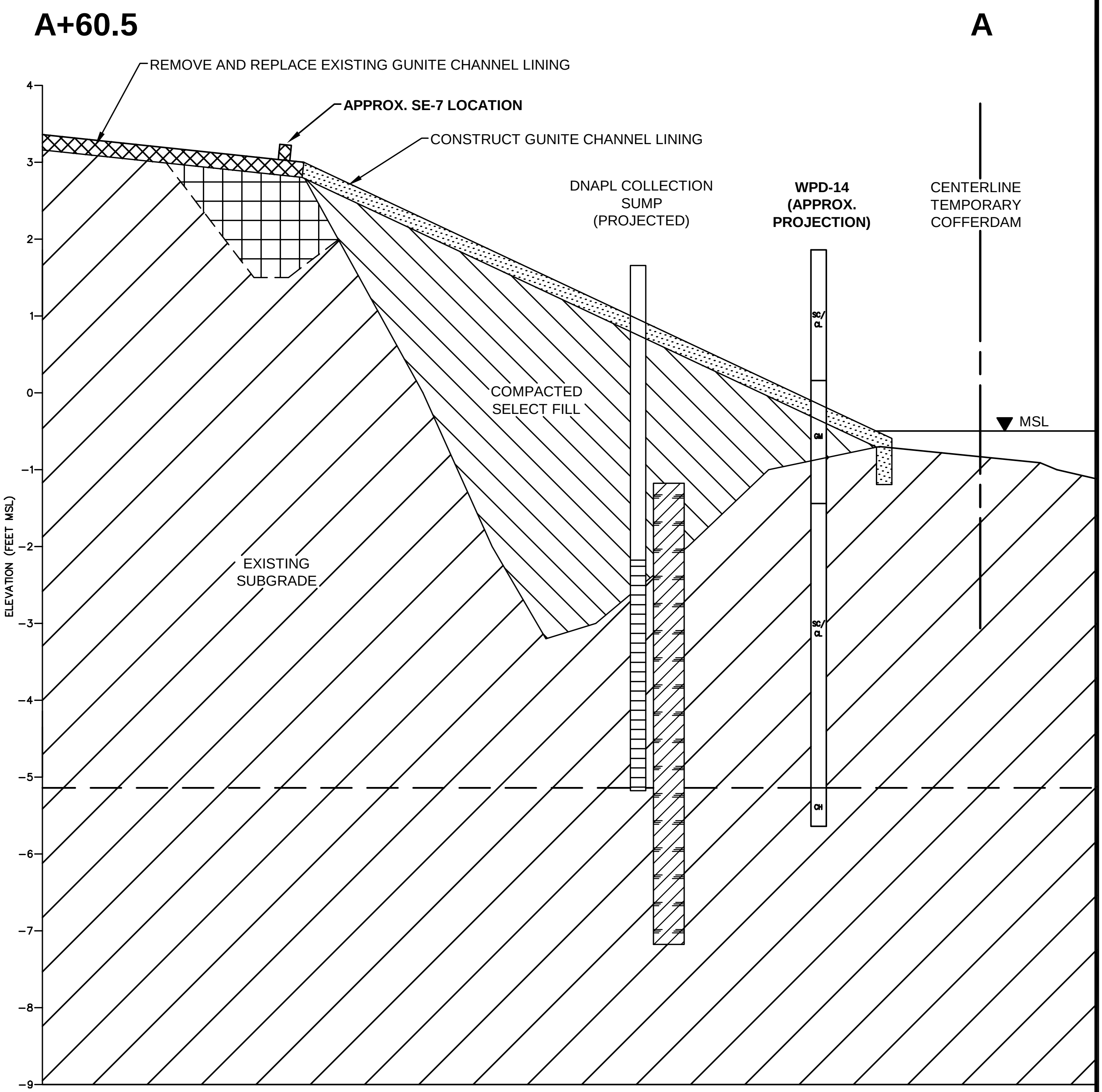
- Proposed DNAPL Collection Sump
- Proposed Barrier Location
- Ditch Area to be Backfilled/Lined with Gunite
- Ditch Area to be Relined
- ▲ Recovery Well With Apparent DNAPL
- ● Soil Boring With Apparent DNAPL
- ✚ Seep With Apparent DNAPL
- □ Monitoring Well Without Apparent DNAPL
- ○ Soil Boring Without Apparent DNAPL

ALCOA

FIGURE 1-3
REMEDY COMPONENT LOCATION MAP

PROJECT: 020101	**DATE: JULY 2003**	
REV:	**BY: BWB**	**CHECKED: DBB**

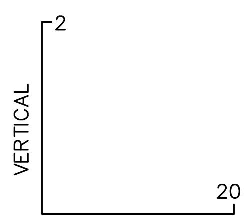
ALCOA
Point Comfort Operations



EXPLANATION

- – – – Approximate Extent of DNAPL–Containing Sediment Excavation
- Compacted Select Fill
- Compacted Backfill in Seep Excavation
- Existing Gunite Lining
- Proposed Gunite Lining
- Proposed Slurry Wall

SCALE IN FEET



10x Vertical Exaggeration

ALCOA
POINT COMFORT OPERATIONS

Figure 2–1

CONCEPTUAL BARRIER PROFILE IN DRAINAGE DITCH AREA

PROJECT: 020101	BY: BWB	REVISIONS
DATE: JAN. 2003	CHECKED: DBB	

MFG, INC.
ENVIRONMENTAL SCIENCES AND ENGINEERING SERVICES

APPENDIX A

Boring Logs from Pre-Design Investigation

consulting scientists and engineers

LOG OF BORING WPD-1

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430992.903
Borehole Diameter	: 2"	Easting	: 2749095.589
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 0.79	DESCRIPTION	USCS	GRAPHIC	Samples
0–0.5		(0.0-0.5) FILL, FL; red-brn clay (5YR 4/2), firm-hard, moist, med.dry-strength, toughness and plasticity, containing abundant mixture of calcareous nodules ~2-4 mm in dia., gravel, refractory brick, GBC.			
0.5–9.0		(0.5-9.0) SILTY SANDY CLAY, SC/CL; lt. gray (10YR 5/1), wet, low-med dry-strength, med toughness and plasticity, ~60% clays, no odor, wet at ~ 1.5'bgs, SBC.	SC/CL		
9.0–9.4		(9.0-9.4) CLAY, CH; lt.green gray (GLEY 7/1), wet, high dry-strength, toughness and plasticity, homogeneous texture, BCNE. Total depth = 9.4 feet.	CH		

Depth scale (feet): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Elevation scale: 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14

consulting scientists and engineers

LOG OF BORING WPD-2

(Page 1 of 1)

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430991.376
Borehole Diameter	: 2"	Easting	: 2749189.041
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 1.10	DESCRIPTION	USCS	GRAPHIC	Samples
0–1.5	1 to -0.4	(0.0-1.5) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled yell-red (5YR 5/6), moist-wet, med dry-strength, toughness and plasticity, minor Fe-stains, calcareous nodules ~ 1mm in dia., no odor, wet at ~ 1.5'bgs, GBC.	SC/CL		
1.5–2.3		(1.5-2.3) SANDY SILTY GRAVEL, GM; lt gray (10YR 5/1), wet, mixture of med sands, silts and gravel becoming coarser with depth, poorly sorted, well rounded, low dry-strength, toughness and plasticity, GBC.	GM		
2.3–8.6		(2.3-8.6) SILTY SANDY CLAY, SC/CL; lt. gray (10YR 5/1), wet, med. dry-strength, toughness and plasticity, ~60% clays, no odor, SBC.	SC/CL		
8.6–8.8		(8.6-8.8) CLAY, CH; lt.green gray (GLEY 7/1), wet, high dry-strength, toughness and plasticity, homogeneous texture, BCNE. Total depth = 8.8 feet.	CH		

Depth scale: 0–15 feet; Surf. Elev. scale: 1 to -13.

07-09-2003 J:\020101\Boring logs\Wpd-2.bor

consulting scientists and engineers

LOG OF BORING WPD-3

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430947.724
Borehole Diameter	: 2"	Easting	: 2749274.715
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 1.53	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0.0-0.5) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled yell-red (5YR 5/6), moist, med dry-strength, toughness and plasticity, minor Fe-stains, calcareous nodules ~ 1mm in dia., no odor,GBC.	SC/CL		
	1				
1		(0.5-7.3) SILTY SANDY CLAY, SC/CL; lt. gray (10YR 5/1), wet, med dry-strength, toughness and plasticity, ~60% clays, no odor, wet at ~ 1.5'bgs, SBC.			
	0				
2					
	-1				
3					
	-2				
4			SC/CL		
	-3				
5					
	-4				
6					
	-5				
7					
	-6	(7.3-7.6) CLAY, CH; lt.green gray (GLEY 7/1), wet, high dry-strength, toughness and plasticity, homogeneous texture, BCNE. Total depth = 7.6 feet.	CH		
8					
	-7				
9					
	-8				
10					

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LOG OF BORING WPD-4 (a,b,c)

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430879.713
Borehole Diameter	: 2"	Easting	: 2749333.313
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 1.48	DESCRIPTION	USCS	GRAPHIC	Samples
0 – 1.8	1.48 – -0.32	(0.0-1.8) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled yell-red (5YR 5/6), moist-wet, med dry-strength, toughness and plasticity, minor Fe-stains, calcareous nodules ~ 1mm in dia., no odor, wet at ~ 1.5'bgs, GBC.	SC/CL		
1.8 – 2.5		(1.8-2.5) SANDY SILTY GRAVEL, GM; lt. gray (10YR 5/1), wet, mixture of med sand, silt and gravel becoming coarser with depth, poorly sorted, well rounded, low dry-strength, toughness and plasticity, free product with oily, bluish-purple sheen with mothball oder encountered from ~1.5-2.5'bgs in WPD-4a & b only, GBC.	GM		
2.5 – 7.0		(2.5-7.0) SILTY SANDY CLAY, SC/CL; lt. gray (10YR 5/1), wet, med. dry-strength, toughness and plasticity, ~60 clays, no odor, SBC.	SC/CL		
7.0 – 7.6		(7.0-7.6) CLAY, CH; lt.green gray (GLEY 7/1), wet, high dry-strength, toughness and plasticity, homogeneous texture, BCNE. Total depth = 7.6 feet.	CH		

Depth scale (feet): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Surface elevation scale: 1, 0, -1, -2, -3, -4, -5, -6, -7, -8

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LOG OF BORING WPD-5

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/13/01	Drilling Company	: Fugro Geosciences, Inc
Borehole Diameter	: 4"	Driller/Driller #	: Mario Moya/4990M
Drilling Method	: CME-750 ATV Rig	Northing	: 13431034.458
Sampling Method	: Shelby Tube Sampler	Easting	: 2749004.237
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 15.19	DESCRIPTION	USCS	Recovery (ft/ft)	Pocket Penetrometer (tons/ft2)	Blow Counts
0	15	(0.0-8.0) FILL, FL; reddish-gray clay (5YR 4/2), moist, firm-hard, med dry strength, toughness, and plasticity, containing abundant mixture of calcareous nodules ~ 2mm in dia., refractory brick, and carbonaceous material, GBC.				
1	14			1.1/2	2.5	
2	13					
3	12			1.2/2	3.0	
4	11					
5	10			1.5/2	3.0	
6	9					
7	8			1.1/2	3.0	
8	7	(8.0-16.2) FILL, FL; gray clay (5YR 5/1), mottled lt. red and black (2.5YR 5/6) & (5YR 2.5/1), moist, firm-soft, med dry-strength, toughness and plasticity, containing minor amounts of subrounded calcareous nodules ~2mm in dia., and root fibers, gravelly clay interval from 14.0-14.2' bgs, gravels are ~2-10 mm in dia., no odor, GBC.				
9	6			1.1/2	1.25	NA
10	5					
11	4			2/2	1.00	
12	3					
13	2			1.8/2	1.5	
14	1					
15	0			2/2	1.5	
16	-1	(16.2-18.0) CLAY, CL; brn-gray (7.5YR 5/2), mottled red-brn (2.5YR 4/6), moist, hard, high dry-strength, toughness and plasticity, homogeneous structure, little Fe-staining, minor amounts of calcareous nodules ~1-2 mm in dia., BCNE.	CL			
17	-2			2/2	2.75	
18	-3	Total depth = 18.0 feet.				
19	-4					
20						

Well completion (0-18 ft): 95% Portland, 5% Bentonite Grout

consulting scientists and engineers

LOG OF BORING WPD-6

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/13/01	Drilling Company	: Fugro Geosciences, Inc
Borehole Diameter	: 4"	Driller/Driller #	: Mario Moya/4990M
Drilling Method	: CME-750 ATV Rig	Northing	: 13431051.394
Sampling Method	: Shelby Tube Sampler	Easting	: 2749110.608
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 14.28	DESCRIPTION	USCS	GRAPHIC	Samples	Recovery (ft/ft)	Pocket Penetrometer (tons/ft2)	Blow Counts
0	14	(0.0-14.2) FILL, FL; red-brn clay (5YR 4/2), firm-hard, dry, med-high dry-strength, med toughness and plasticity, containing abundant mixture of carbonaceous material, subrounded calcareous nodules ~1-2mm in dia., gravel, bark, refractory brick, becoming less abundant at base, GBC.						
1	13					2/2	3.5	
2	12							
3	11					1.7/2	3.5	
4	10							
5	9					1/2	3.0	3 6 10
6	8							
7	7					1.6/2	1.5	
8	6							
9	5					0.7/2	2.0	
10	4							
11	3					1.4/2	2.0	
12	2							
13	1					1.4/2	1.0	
14	0	(14.2-20) SANDY SILTY CLAY, SC/CL; gray (5Y 3/1), wet, very soft, rapid dilatency, composed of fine sand, well rounded poorly sorted qtz grains ~95%, 5% dk minerals, wet at ~16.3' bgs, homogeneous structure, encountered gray (5YR 5/1) fill interval mottled red & black (2.5YR 5/6) & (5YR 2.5/1) from 14.4-14.8'bgs containing minor Fe-staining and calcareous nodules ~1mm in dia, BCNE.						
15	-1					1.5/2	1.25	
16	-2							
17	-3		SC/CL			1.2/2	NA	
18	-4	Total depth = 20.0 feet.						
19	-5					NR	NA	
20	-6							
21	-7							
22	-8							
23	-9							
24	-10							
25								

95% Portland, 5% Bentonite Grout

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LOG OF BORING WPD-7

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/13/01	Drilling Company	: Fugro Geosciences, Inc
Borehole Diameter	: 4"	Driller/Driller #	: Mario Moya/4990M
Drilling Method	: CME-750 ATV Rig	Northing	: 13431033.168
Sampling Method	: Shelby Tube Sampler	Easting	: 2749242.734
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 14.97	DESCRIPTION	USCS	GRAPHIC	Samples	Recovery (ft/ft)	Pocket Penetrometer (tons/ft2)	Blow Counts
0		(0.0-14.0) FILL, FL; red-brn clay (5YR 4/2), firm-hard, dry, med. dry-strength, toughness and plasticity, containing abundant mixture of calcareous nodules ~2-4 mm in dia., gravel, refractory brick, becoming less abundant at base, minor carbonaceous material, bark, GBC.						
1	14					1.5/2	2.0	
2	13							
3	12					1.7/2	4.0	
4	11							
5	10					1.5/2	2.0	
6	9							
7	8					1.5/2	0.5	13 8 4
8	7							
9	6					1/2	1.5	
10	5							
11	4					1.3/5	0.5	
12	3							
13	2					2/2	0.5	
14	1	(14.0-16.0) SANDY SILTY CLAY, SC/CL; dk gray (5Y 3/1), very soft, low dry-strength, toughness and plasticity, containing well rounded poorly sorted fine sand composed of ~ 95% qtz, ~5% dk minerals, layer of solid carbonaceous rich material (pitch) from 14.2-14.4'bgs containing a strong mothball odor, wet @ ~ 11'bgs, BCNE. Total depth = 16.0 feet.						
15	0		SC/CL			1/2	NA	
16	-1							
17	-2							
18	-3							
19	-4							
20	-5							

95% Portland, 5% Bentonite Grout

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LOG OF BORING WPD-8

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020073

Date	: 2/14/01	Drilling Company	: Fugro Geosciences, Inc
Borehole Diameter	: 4"	Driller/Driller #	: Mario Moya/4990M
Drilling Method	: CME-750 ATV Rig	Northing	: 13431099.072
Sampling Method	: Shelby Tube Sampler	Easting	: 2749265.868
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 15.62	DESCRIPTION	USCS	GRAPHIC	Samples	Recovery (ft/ft)	Pocket Penetrometer (tons/ft2)	Blow Counts
0.0-13.5		(0.0-13.5) FILL, FL; red-brn clay (5YR 4/2), becoming dk gray (10YR 3/1) firm-hard, dry-moist, med dry-strength, toughness and plasticity, containing abundant mixture of calcareous nodules ~1-2 mm in dia., gravel ~ 2cm in dia., refractory brick, and carbonaceous material containing mild mothball odor (pitch) from 8.0-11.0' bgs, becoming less abundant at base, minor amounts of bark, GBC.						
0-2						2/2	1.5	
2-4						1.5/2	3.5	
4-6						2/2	4.0	
6-8						1.2/2	2.5	8 7 9
8-10						1.3/2	1.5	
10-12						1/2	1.5	
12-14						1.5/2	0.5	5 6 8
13.5-14.0		(13.5-14.0) SANDY SILTY CLAY, SC/CL; dk. gray (5Y 3/1), moist, very soft, low dry-strength, toughness and plasticity, containing well rounded poorly sorted fine sand composed of ~ 95% qtz, ~5% dk minerals, rapid dilatency, GBC.	SC/CL					
14.0-16.0		(14.0-16.0) SANDY GRAVEL, GW; grayish-yellow (10YR 5/4), moist-wet, soft, low dry-strength, toughness, non-plastic, containing abundant shell material, med sand and gravel are subangular to subrounded, poorly sorted, wet at ~ 15.5'bgs, GBC.	GW			1.7/2	N/A	
16.0-20.0		(16.0-20.0) SANDY SILTY CLAY, SC/CL; lt. gray (10YR 5/1), wet, very soft, low dry-strength, toughness and plasticity, containing well rounded poorly sorted fine sand composed of ~ 95% qtz, ~5% dk. minerals, rapid dilatency, coarsening with depth from fine sand/silt/clay to med. sands at base, BCNE.	SC/CL					
16-18						2/2	N/A	
18-20						2/2	N/A	
		Total depth = 20.0 feet.						

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
Elevation scale: 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, -1, -2, -3, -4, -5, -6, -7, -8, -9

95% Portland, 5% Bentonite Grout

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LOG OF BORING WPD-9

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/13/01	Drilling Company	: Fugro Geosciences, Inc
Borehole Diameter	: 4"	Driller/Driller #	: Mario Moya/4990M
Drilling Method	: CME-750 ATV Rig	Northing	: 13430980.690
Sampling Method	: Shelby Tube Sampler	Easting	: 2749318.334
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 16.14	DESCRIPTION	USCS	GRAPHIC
0–11	16–5	(0.0-11.0) FILL, FL; red-brn (5YR 4/2) clay, dry to wet, firm-hard, med dry-strength, toughness and plasticity, containing abundant mixture of calcareous nodules ~2-5 mm in dia., gravel ~ 1-2 cm in dia, and refractory brick, becoming less abundant at base with minor amounts of carbonaceous material and root material, wet at ~ 10.0' bgs, GBC.		
11–20	5–-3	(11.0-20.0) SANDY SILTY CLAY, SC/CL; dk. gray (5Y 3/1), wet, very soft, low dry-strength, toughness and plasticity, rapid dilatency, coarsening with depth from fine sand/silt/clay to med. sands at base, solid carbonaceous nodule(pitch) encountered at ~ 13.5'bgs, mild creosote odor from 11.0-12.0'bgs to strong creosote odor from 12.0-14.0'bgs, BCNE. Total depth = 20.0 feet.	SC/CL	

Depth in Feet	Surf. Elev.	Recovery (ft/ft)	Pocket Penetrometer (tons/ft2)	Blow Counts
1	15	1.2/2	1.5	
3	13	1.5/2	2.5	
5	11	2/2	3.0	
7	9	1.7/2	2.0	3 9 14
9	7	1.7/2	1.5	
11	5	1.2/2	0.5	
13	3	1.3/2	N/A	
15	1	0.3/2	N/A	
17	-1	0.3/2	N/A	
19	-3	0.1/2	N/A	

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LOG OF BORING WPD-10

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Drilling Company	: Fugro Geosciences, Inc
Borehole Diameter	: 4"	Driller/Driller #	: Mario Moya/4990M
Drilling Method	: CME-750 ATV Rig	Northing	: 13431076.754
Sampling Method	: Shelby Tube Sampler	Easting	: 2749340.313
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 16.93	DESCRIPTION	USCS	GRAPHIC	Samples	Recovery (ft/ft)	Pocket Penetrometer (tons/ft2)	Blow Counts
0		(0.0-17.8) FILL, FL; dk gray (10YR 3/1) clay, firm-hard, dry-moist, med dry-strength, toughness and plasticity, containing very little mixture of calcareous nodules ~1-2 mm in dia., subrounded to subangular gravels ~ 1 cm in dia., GBC.						
1	16					2/2	1.0	
2	15							
3	14					1.5/2	2.5	
4	13							
5	12					2/2	1.0	
6	11							
7	10					1.2/2	2.0	4 10 18
8	9							
9	8					1.3/2	2.5	
10	7							
11	6					1/2	3.0	
12	5							
13	4					1.5/2	2.5	4 6 8
14	3							
15	2					1.7/2	2.5	
16	1							
17	0					2/2	2.0	
18	-1	(17.8-18.8) SANDY SILTY CLAY, SC/CL; dk gray (5Y 3/1), moist, very soft, low dry-strength and toughness, low plasticity, stratified structure with 1mm laminae containing well rounded poorly sorted fine to med sand silt, containing little shell material GBC.	SC/CL					
19	-2	(18.8-20.0) CLAY, CH; greenish-gray (GLEY 7/2), moist, high dry-strength and toughness, med plasticity, slickensided texture, BCNE.	CH			2/2	N/A	
20	-3	Total depth = 20.0 feet.						
21	-4							
22	-5							
23	-6							
24	-7							
25	-8							

95% Portland, 5% Bentonite Grout

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LOG OF BORING WPD-11

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430826.776
Borehole Diameter	: 2"	Easting	: 2749401.690
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 2.34	DESCRIPTION	USCS	GRAPHIC	Samples
0	2	(0.0-1.0) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled lt. yell-red (5YR 5/6), moist-wet, wet at ~1.0'bgs, low dry-strength, toughness and plasticity, Fe-stained, calcareous nodules ~ 1mm in dia., no odor, GBC.	SC/CL		
1	1	(1.0-2.0) SILTY CLAY; CL; yell-brn (10YR 6/3), mottled yell-red (5YR 5/6), wet, med dry-strength, toughness and med-high plasticity, homogeneous texture, no odor, GBC.	CL		
2	0	(2.0-5.0) SANDY SILT CLAY, SC/CL; lt. gray (10YR 5/1), wet, low dry-strength, toughness and plasticity, containing well rounded poorly sorted fine sand/silt, ~ 65% clay, no odor, BCNE. Total depth = 5.0 feet.	SC/CL		
3	-1				
4	-2				
5	-3				
6	-4				
7	-5				
8					

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LOG OF BORING WPD-12

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430819.759
Borehole Diameter	: 2"	Easting	: 2749338.678
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 1.45	DESCRIPTION	USCS	GRAPHIC	Samples
0	1	(0.0-0.5) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled lt. yell-red (5YR 5/6), moist, low dry-strength, toughness and plasticity, Fe-stained, calcareous nodules ~ 1mm in dia., no odor, GBC.	SC/CL		
1	0	(0.5-2.0) SILTY SAND, SM; green-gray (GLEY 7/1), wet, wet at ~1.0'bgs, low dry-strength, toughness, and plasticity, homogeneous texture, composed of fine sand and silt, no odor, GBC.	SM		
2	-1	(2.0-3.2) SANDY SILTY GRAVEL, GM; lt. gray (10YR 5/1), med sand, silt and gravel becoming coarser with depth, low dry-strength, toughness and plasticity, lt green (GLEY 7/2) silty clay interval encountered from 2.5-2.7'bgs, GBC.	GM		
3	-2	(3.2-5.0) CLAY, CL; lt. gray (10YR 5/1) mottled red-brn (5YR 4/4), med dry-strength, toughness, and plasticity, homogeneous structure, BCNE. Total depth = 5.0 feet.	CL		
4	-3				
5	-4				
6	-5				
7	-6				
8					

LOG OF BORING WPD-13

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Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430855.995
Borehole Diameter	: 2"	Easting	: 2749320.526
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 1.48	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0.0-2.5) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled yell-red (5YR 5/6), moist-wet, med dry-strength, toughness and plasticity, minor Fe-stains, calcareous nodules ~ 1mm in dia., no odor, wet at ~ 1.5'bgs, GBC.	SC/CL		
2.5		(2.5-3.7) SANDY SILTY GRAVEL, GM; lt. gray (10YR 5/1), wet, mixture of med. sand/silt and gravels becoming coarser with depth, poorly sorted, well rounded, low dry-strength, toughness and plasticity, GBC.	GM		
3.7		(3.7-6.75) SILTY SANDY CLAY, SC/CL; lt. gray (10YR 5/1), wet, med. dry-strength, toughness and plasticity, ~60 clays, SBC.	SC/CL		
6.75		(6.75-8.0) CLAY, CH; lt.green gray (GLEY 7/1), wet, high dry-strength, toughness and plasticity, homogeneous texture, BCNE. Total depth = 8.0 feet.	CH		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Elevation scale: 1, 0, -1, -2, -3, -4, -5, -6, -7, -8.

LOG OF BORING WPD-14

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Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/14/01	Northing	: 13430909.842
Borehole Diameter	: 2"	Easting	: 2749380.566
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Kaveh Khorzad, MFG		

Depth in Feet	Surf. Elev. 1.86	DESCRIPTION	USCS	GRAPHIC	Samples
0–1.7	1.86–0.16	(0.0-1.7) SANDY CLAY, SC/CL; yell-brn (10YR 6/3), mottled yell-red (5YR 5/6), moist-wet, med dry-strength, toughness and plasticity, minor Fe-stains, calcareous nodules ~ 1mm in dia., no odor, wet at ~ 1.5'bgs, minor oily blueish-purple sheen encountered at 1.0'bgs ~2 mm thick, minor mothball odor, GBC.	SC/CL		
1.7–3.3		(1.7-3.3) SANDY SILTY GRAVEL, GM; lt. gray (10YR 5/1), wet, mixture of med. sand, silt and gravel becoming coarser with depth, poorly sorted, well rounded, low dry-strength, toughness and plasticity, GBC.	GM		
3.3–7.0		(3.3-7.0) SILTY SANDY CLAY, SC/CL; lt. gray (10YR 5/1), wet, med dry-strength, toughness and plasticity, ~60 clays, no odor, SBC.	SC/CL		
7.0–7.5		(7.0-7.5) CLAY, CH; lt.green gray (GLEY 7/1), wet, high dry-strength, toughness and plasticity, homogeneous texture, BCNE.	CH		

Total Depth = 7.5 feet

Depth scale (feet): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Elevation scale: 1, 0, -1, -2, -3, -4, -5, -6, -7, -8

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LOG OF BORING WPD-15

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430916.311
Borehole Diameter	: 2"	Easting	: 2749344.858
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.64	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.83) - SANDY SILT, ML, with detritus, brown	ML		
	1				
1		(0.83 - 1.5) - SANDY SILT, ML, grey	ML		
	0	(1.5 - 2) - SILTY SAND with some GRAVEL, GM, grey	GM		
2		(2 - 4.3) - SANDY SILT, ML, grey-brown	ML		
	-1				
3					
	-2				
4					
	-3	(4.3 - 7) - SILTY SAND, SM, grey	SM		
5					
	-4				
6					
	-5				⊠
7		(~7) - CLAY, CL, grey-green			
	-6				
8					
	-7				
9					
	-8				
10					

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LOG OF BORING WPD-16

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Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430896.916
Borehole Diameter	: 2"	Easting	: 2749322.133
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.33	DESCRIPTION	USCS	GRAPHIC	Samples
0	1	(0 - 1) - SANDY SILT, ML, brown	ML		
1	0	(1- 2.2) - SANDY SILT, ML, brown	ML		
2	-1	(2.2 - 3) - SANDY SILT, GM, grey with some GRAVEL (1.8 - 2.7) - some oil sheen on sediment and a few small globs of DNAPL; oil sheen on water in borehole; light odor (creosote) detected	GM		
3	-2	~2.5 feet creosote began to "pool" in soil boring and on the ground (3 - 4) - SANDY SILT, ML, grey-brown	ML		
4	-3	(4 - 7) - SILTY SAND, SM, brown	SM		
5	-4				
6	-5				
7	-6				
8	-7				
9	-8				
10					

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LOG OF BORING WPD-17

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01
Borehole Diameter	: 2"
Drilling Method	: Hand Auger
Sampling Method	: 2" X 2' Split Spoon Sampler
Geologist	: Travis Hanna
Northing	: 13430877.769
Easting	: 2749299.680

Depth in Feet	Surf. Elev. 0.53	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.3) - SANDY SILT with detritus, ML, brown	ML		
	0	(0.3 - 3.8) - SANDY SILT, ML, grey	ML		
1	-1				
2	-2				
3	-3				
4		(3.8 - 4.5) - SANDY SILT, ML, brown	ML		
	-4	(4.5 - 5.7) - SANDY SILT, ML, grey-brown	ML		
5	-5				
6		(5.7 - 7) - SILTY SAND, SM, grey-brown	SM		
	-6				
7		Note: Sample site is covered with about 4 inches of water			
	-7				
8	-8				
9	-9				
10					

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LOG OF BORING WPD-18

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Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430895.804
Borehole Diameter	: 2"	Easting	: 2749366.115
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.70	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.75) - SANDY SILT with detritus, ML, brown	ML		
	1	(0.75 - 1) - SANDY SILT, ML, grey	ML		
1	0	(1 - 1.83) - SILTY SAND with some GRAVEL, GM, grey and tan	GM		
2		(1.83 - 2.5) - SILTY GRAVEL with some sand, GM, tan	GM		
3	-1, -2	(2.5 - 4.3) - SANDY SILT, ML, red-brown	ML		
4	-3	(4.3 - 4.8) - SANDY SILT, ML, grey	ML		
5		(4.8 - 5) - SAND, SW, grey	SW		
6	-4	(5 - 6.7) - SANDY SILT, ML, red-brown and grey	ML		
7	-5	(6.7 - 7) - SAND, SW, grey	SW		
		(7 feet +) - clay			
8	-6				
9	-7				
10	-8				

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LOG OF BORING WPD-19

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430876.534
Borehole Diameter	: 2"	Easting	: 2749343.321
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.57	DESCRIPTION	USCS	GRAPHIC	Samples
0	1	(0 - 1.2) - SANDY SILT, ML, brown	ML		
1	0	(1.2 - 1.75) - SANDY SILT, ML, grey	ML		
2	-1	(1.75 - 2.5) - SILTY SAND with some GRAVEL, GM, grey	GM		
3	-2	(2.5 - 3.7) - SANDY SILT and CLAY, CL, grey with clumps of red clay	CL		
4	-3	(3.7 - 6) - SILTY SAND, SM, grey	SM		
5	-4				
6	-5	(6 - 7) - SILTY SAND, SM, grey	SM		
7	-6	Note: Minor sheen in water in borehole			
8	-7				
9	-8				
10					

LOG OF BORING WPD-20

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Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430889.424
Borehole Diameter	: 2"	Easting	: 2749402.351
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.85	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 1) - SANDY SILT, ML, brown with detritus	ML		
1	1	(1 - 5.7) - SANDY SILT, ML, grey	ML		
2	0				
3	-1				
4	-2				
5	-3				
	-4	(5.7 - 5.8) - SAND, SW , grey	SW		
6		(5.8 - 6) - CLAY, CL, grey-green	CL		
7	-5				
8	-6				
9	-7				
10	-8				

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LOG OF BORING WPD-21

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430873.969
Borehole Diameter	: 2"	Easting	: 2749386.698
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.86	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.25) - SANDY SILT, ML, brown	ML		
		(0.25 - 0.33) - Black top soil ?			
	1	(0.33 - 2.7) - SANDY SILT, ML, grey-brown	ML		
2	0				
3	-1	(2.7 - 3.3) - SANDY SILT with GRAVEL, GM, grey	GM		
4	-2	(3.3 - 4.5) - SANDY SILT, ML, grey-brown	ML		
5	-3	(4.5 - 5) - SAND, SW, grey-brown	SW		
		(5 - 5.4) - SILT, ML, grey-brown	ML		
6	-4	(5.4 - 6.7) - SANDY SILT, ML, grey-brown	ML		
7	-5	(6.7 - 7.5) - SAND, SW, grey	SW		
		(7.5 - 7.7) - CLAY, CL, grey-brown	CL		
8	-6				
9	-7				
10	-8				

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LOG OF BORING WPD-22

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430856.207
Borehole Diameter	: 2"	Easting	: 2749363.917
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 0.79	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.5) - SANDY SILT with detritus, ML, brown	ML		
	0	(0.5 - 1.25) - SANDY SILT, ML, grey-brown	ML		
1		(1.25 - 1.67) - Black tar-like layer (creosote)			
	-1	Light sheen and creosote odor detected from 1.25 ft - 3 ft. No sheen noticed on water.			
2		(1.67 - 2.4) - SANDY SILT, ML, grey	ML		
		(2.4 - 3) - SAND, SW, grey	SW		
3	-2	(3 - 3.5) - SANDY SILT, ML, grey	ML		
	-3	(3.5 - 6.5) - SAND, SW, brown	SW		
4					
5	-4				
6	-5				
	-6	(6.5 - 6.7) - CLAY, CL, grey-green	CL		
7					
	-7	Note: Sample site is covered in about 4 inches of water			
8					
9	-8				
10	-9				

07-09-2003 J:\020101\Boring logs\WPD-22.bor

LOG OF BORING WPD-23

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Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430834.001
Borehole Diameter	: 2"	Easting	: 2749340.945
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 0.58	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.25) - SANDY SILT with detritus, ML, brown	ML		
		(0.25 - 4) - SANDY SILT, ML, grey	ML		
4		(4 - 4.2) - SILTY SAND, brown, with GRAVEL and grey-green CLAY	GC		
		(4.2 - 4.3) - SANDY SILT, ML, brown	ML		
		(4.3 - 4.7) - SILTY SAND, SM, brown	SM		
		(4.7 - 5.2) - SANDY SILT, ML, brown	ML		
		(5.2 - 7) - SAND, SW, grey-brown	SW		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Elevation scale: 0, -1, -2, -3, -4, -5, -6, -7, -8, -9

Note : Sample site is covered in 4 inches of water

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LOG OF BORING WPD-24

(Page 1 of 1)

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430814.956
Borehole Diameter	: 2"	Easting	: 2749319.128
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.10	DESCRIPTION	USCS	GRAPHIC	Samples
0	1	(0 - 0.33) - SANDY SILT with detritus, ML, brown	ML		
1	0	(0.33 - 4.5) - SANDY SILT, ML, grey	ML		
2	-1				
3	-2				
4	-3				
		(4.5 - 4.8) - SILTY SAND, SM, grey	SM		
		(4.8 - 5) - SANDY SILT with GRAVEL, GM, brown	GM		
5	-4	(5 - 5.7) - SANDY SILT, ML, grey	ML		
		(5.7 - 5.8) - SANDY SILT with GRAVEL, GM, brown	GM		
6	-5	(5.8 - 6.7) - SILTY SAND, SM, grey-brown	SM		
7	-6				
8	-7				
9	-8				
10					

Note : Sample site is covered in about 4 inches of water

07-09-2003 J:\020101\Boring logs\WPD-24.bor

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LOG OF BORING WPD-25

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/27/01	Northing	: 13430851.986
Borehole Diameter	: 2"	Easting	: 2749407.947
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Surf. Elev. 1.36

DESCRIPTION	USCS
(0 - 0.67) - SANDY SILT with detritus, ML, brown	ML
(0.67 - 1.5) - SANDY SILT, ML, grey-brown	ML
(1.5 - 1.83) - SANDY SILT, ML, grey-brown	ML
(1.83 - 3.2) - SANDY SILT, brown, with grey and red CLAYS, GRAVEL, roots and black blotches	GC
(3.2 - 4) - SILTY SAND, SM, grey	SM
(4 - 4.8) - SILTY SAND, SM, grey	SM
(4.8 - 6.8) - SANDY SILT, ML, grey	ML
(6.8 - 7) - CLAY, CL, grey-green	CL

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LOG OF BORING WPD-26

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date : 2/28/01
Borehole Diameter : 2"
Drilling Method : Hand Auger
Sampling Method : 2" X 2' Split Spoon Sampler
Geologist : Travis Hanna

Northing : 13430832.971
Easting : 2749385.382

Depth in Feet	Surf. Elev. 2.06	DESCRIPTION	USCS	GRAPHIC	Samples
0	2	(0 - 2.8) - SANDY SILT, ML, grey-brown	ML		
2.8		(2.8 - 3.2) - SANDY SILT with GRAVEL, GM, brown-grey	GM		
3.2		(3.2 - 4.8) - SILTY SAND, SM, grey brown	SM		
4.8		(4.8 - 5.5) - SANDY SILT, ML, grey-brown	ML		
5.5		(5.5 - 6.2) - SILTY SAND, SM, grey-brown	SM		
6.2		(6.2 - 7) - SANDY SILT, ML, grey-brown	ML		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Elevation scale: 2, 1, 0, -1, -2, -3, -4, -5, -6, -7

consulting scientists and engineers

LOG OF BORING WPD-27

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/28/01	Northing	: 13430814.332
Borehole Diameter	: 2"	Easting	: 2749362.074
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 2.69	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.5) - SANDY SILT, ML, grey-brown	ML		
	2	(0.5 - 1.92) - SILTY SAND, SM, tan and grey	SM		
1	1				
2		(1.92 - 2.7) - SANDY SILT, ML, grey	ML		
	0	(2.7 - 2.9) - SANDY SILT with GRAVEL, GM, brown	GM		
3		(2.9 - 3.2) - SANDY SILT, ML, brown	ML		
		(3.2 - 3.5) - SANDY SILT,dark grey, with some CLAY chunks, grey-green	CL		
	-1	(3.5 - 4.2) - SANDY SILT, ML, dark grey, with shell frags. and rocks	ML		
4		(4.2 - 5) - SILTY SAND, SM, grey	SM		
	-2				
5		(5 - 5.7) - SANDY SILT, ML, grey-brown	ML		
	-3	(5.7 - 5.8) - CLAY, CL, mix of red, black and grey-green	CL		
6					
	-4				
7					
	-5				
8					
	-6				
9					
	-7				
10					

LOG OF BORING WPD-28

(Page 1 of 1)

consulting scientists and engineers

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/28/01	Northing	: 13430795.133
Borehole Diameter	: 2"	Easting	: 2749339.250
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 2.25	DESCRIPTION	USCS	GRAPHIC	Samples
0	2	(0 - 1.67) - SILTY SAND, SM, tan	SM		
1	1				
2		(1.67 - 2.17) - SANDY SILT, grey brown, with CLAY, red and grey	CL		
	0	(2.17 - 4.67) - SANDY SILT, ML, grey-brown	ML		
3	-1				
4	-2				
5		(4.67 - 5.17) - SANDY SILT with GRAVEL, GM, grey-brown	GM		
	-3	(5.17 - 5.67) - SANDY SILT with GRAVEL, GM, grey-brown	GM		
6	-4	(5.67 - 7) - SAND, grey ~7 feet - grey-green clay	SW		
7	-5				
8	-6				
9	-7				
10					

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LOG OF BORING WPD-29

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/28/01	Northing	: 13430812.383
Borehole Diameter	: 2"	Easting	: 2749405.966
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 2.39	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.25) - SANDY SILT, ML, brown	ML		
	2	(0.25 - 0.75) - SAND, SW, tan	SW		
1	1	(0.75 - 2) - SANDY SILT, grey-brown, with red and grey-green CLAY	CL		
2	0	(2 - 2.5) - CLAY, CL, black, red and grey-green	CL		
3	-1				
4	-2				
5	-3				
6	-4				
7	-5				
8	-6				
9	-7				
10					

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LOG OF BORING WPD-30

Witco Pre-Design Investigation
Alcoa Point Comfort Operations
Point Comfort, Texas

Project No. 020101

Date	: 2/28/01	Northing	: 13430793.223
Borehole Diameter	: 2"	Easting	: 2749383.568
Drilling Method	: Hand Auger		
Sampling Method	: 2" X 2' Split Spoon Sampler		
Geologist	: Travis Hanna		

Depth in Feet	Surf. Elev. 1.39	DESCRIPTION	USCS	GRAPHIC	Samples
0		(0 - 0.33) - SILTY SAND, SM, tan	SM		
	1	(0.33 - 0.83) - SILTY SAND, tan, with red and grey-green CLAY	CL		
1	0	(0.83 - 2.17) - CLAY, CL, black, red and grey-green	CL		
2	-1				
3	-2				
4	-3				
5	-4				
6	-5				
7	-6				
8	-7				
9	-8				
10					

APPENDIX B

Waste Characterization Data

Lancaster Laboratories
Where quality is a science.

ANALYTICAL RESULTS

Prepared for:

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

SAMPLE GROUP

The sample group for this submittal is 751215. Samples arrived at the laboratory on Saturday, February 17, 2001. The PO# for this group is 020073.

Client Description	Lancaster Labs Number
WPD-4C (1.5-2.5) Composite Soil Sample	3554014
WPD-4C (1.5-2.5) Composite Soil Sample	3554015

METHODOLOGY

The specific methodologies used in obtaining the enclosed analytical results are indicated on the laboratory chronicles.

2 COPIES TO McCulley Frick & Gilman, Inc. Attn: Mr. Kaveh Khorzad

Questions? Contact your Client Services Representative
Kathy Klinefelter at (717) 656-2300.

Respectfully Submitted,

Christine M. Ratcliff

Christine M. Ratcliff
[illegible]/Coordinator

Analysis Report

Lancaster Laboratories
Where quality is a science.

Lancaster Laboratories Sample No. SW 3554014

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

WPD46

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit	Units	Dilution Factor
00111	Moisture	n.a.	27.482945	0.50	% by wt.	1
	"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The result reported above is on an as-received basis.					
05895	Total Cyanide (solid)	57-12-5	0.120355J	0.25	mg/kg	1
08750	TX Method 1005 - TPH (soils)					
08751	C6 - C10 Hydrocarbons	n.a.	N.D.	11.	mg/kg	1
08752	>C10 - C28 Hydrocarbons	n.a.	44.942692	11.	mg/kg	1
08753	Total C6 - C28 Hydrocarbons	n.a.	44.942692	28.	mg/kg	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00111	Moisture	EPA 160.3 modified	1	02/20/2001 17:41	Justin M. Bowers	1
05895	Total Cyanide (solid)	SW-846 9012A	1	02/20/2001 15:24	Matthew J. Mercer	1
08750	TX Method 1005 - TPH (soils)	TNRCC TX 1005, 4/98	1	02/22/2001 17:13	Matthew S. Thomas	1
05896	Cyanide Solid Distillation	SW846 9012A, mod.	1	02/20/2001 11:35	Cheryl L. Robinson	1
07004	Extraction - DRO (Soils)	TNRCC TX 1005, 04/98	1	02/21/2001 11:00	John M. Becker	1

Lancaster Laboratories
Where quality is a science.

Lancaster Laboratories Sample No. TL 3554015

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
TCLP NON-VOLATILE EXTRACTION
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

NV-46

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	0.000026J	0.00012	mg/l	1

The metal analyses were performed on a non-volatile leachate prepared according to the procedure specified in SW-846, Chapter 7.4 (Revision 3, December, 1994). A sample is considered to have failed the Toxicity Characteristic (TC) test and is considered a hazardous waste if any of the metal concentrations (mg/l) in the leachate exceed the following maxima (100 times the Primary Drinking Water Standards):

Arsenic	5.0	Cadmium	1.0	Lead	5.0	Selenium	1.0
Barium	100.0	Chromium	5.0	Mercury	0.2	Silver	5.0

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
01335	Arsenic	7440-38-2	0.01161J	0.032	mg/l	1
01336	Selenium	7782-49-2	0.00376J	0.060	mg/l	1
01746	Barium	7440-39-3	0.66844	0.0017	mg/l	1
01749	Cadmium	7440-43-9	0.00192J	0.0036	mg/l	1
01751	Chromium	7440-47-3	0.00189J	0.0066	mg/l	1
01755	Lead	7439-92-1	0.01968J	0.030	mg/l	1
01766	Silver	7440-22-4	-0.00127J	0.0036	mg/l	1
00949	TCLP Acid Base/Neutrals					
03324	Pyridine	110-86-1	N.D.	0.0040	mg/l	1
03325	1,4-Dichlorobenzene	106-46-7	N.D.	0.0020	mg/l	1
03326	2-Methylphenol	95-48-7	N.D.	0.0020	mg/l	1
03327	4-Methylphenol	106-44-5	N.D.	0.0060	mg/l	1

3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
03328	Hexachloroethane	67-72-1	N.D.	0.0020	mg/l	1
03329	Nitrobenzene	98-95-3	N.D.	0.0020	mg/l	1
03330	Hexachlorobutadiene	87-68-3	N.D.	0.0040	mg/l	1
03331	2,4,6-Trichlorophenol	88-06-2	N.D.	0.0040	mg/l	1
03332	2,4,5-Trichlorophenol	95-95-4	N.D.	0.0040	mg/l	1
03333	2,4-Dinitrotoluene	121-14-2	N.D.	0.0020	mg/l	1
03334	Hexachlorobenzene	118-74-1	N.D.	0.0040	mg/l	1
03335	Pentachlorophenol	87-86-5	N.D.	0.0060	mg/l	1

Lancaster Laboratories
Where quality is a science.

Lancaster Laboratories Sample No. TL 3554015

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
TCLP NON-VOLATILE EXTRACTION
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

NV-46

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor

The semivolatile analyses were performed on a non-volatile toxicity characteristic leachate of the submitted waste. The leachate was prepared according to the procedure specified in SW-846, Chapter 7.4 (Revision 3, 12/94). If the TCLP extract contains any one of the Toxicity Characteristic (TC) constituents in an amount equal to or exceeding the concentrations specified in 40 CFR part 261.24, the waste possesses the characteristic of toxicity and is a hazardous waste. These limits are listed below in mg/L. Other limits may apply for analyses performed under other regulations.

Total Methylphenols	200.0	Nitrobenzene	2.0
1,4-Dichlorobenzene	7.5	Pentachlorophenol	100.0
2,4-Dinitrotoluene	0.13	Pyridine	5.0
Hexachlorobenzene	0.13	2,4,5-Trichlorophenol	400.0
Hexachlorobutadiene	0.5	2,4,6-Trichlorophenol	2.0
Hexachloroethane	3.0		

Sufficient sample volume was not available to perform a MS/MSD for this analysis. Therefore, a LCS/LCSD was performed to demonstrate precision and accuracy at a batch level.

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	02/21/2001 09:27	Damary S. Valentin	1
01335	Arsenic	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01336	Selenium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01746	Barium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01749	Cadmium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01751	Chromium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01755	Lead	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01766	Silver	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
00949	TCLP Acid Base/Neutrals	SW-846 8270C	1	02/21/2001 14:44	Mark A. Ratcliff	1
00947	TCLP Non-volatile Extraction	SW-846 1311	1	02/19/2001 13:00	Minerva Diaz	n.a.
04731	TCLP Leachate Extraction	SW-846 3510C	1	02/20/2001 17:00	Desiree J. Wann	1

MEMBER ACIL
Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax: 717-656-2681

Lancaster Laboratories
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Lancaster Laboratories Sample No. TL 3554015

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
TCLP NON-VOLATILE EXTRACTION
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

NV-46

05705	WW/TL SW 846 ICP Digest (tot)	SW-846 3010A	1	02/20/2001 15:30	Liana C. Jones	1
05705	WW/TL SW 846 ICP Digest (tot)	SW-846 3010A	2	02/21/2001 15:15	Liana C. Jones	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	02/20/2001 20:39	Nelli S. Markaryan	1

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Quality Control Summary

Client Name: McCulley Frick & Gilman, Inc. Group Number: 751215
Reported: 03/02/01 at 02:37 PM

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 010511022010A	Sample number(s): 3554014							
Total Cyanide (solid)	N.D.	.18	mg/kg	105	108	89-110	3	20
Batch number: 010515713001	Sample number(s): 3554015							
Mercury	N.D.	.00012	mg/l	107	102	84-124	5	20
Batch number: 01051820002A	Sample number(s): 3554014							
Moisture				100	100	99-101	0	4
Batch number: 01051WAD026	Sample number(s): 3554015							
Pyridine	N.D.	.004	mg/l	60	59	21-107	2	30
1,4-Dichlorobenzene	N.D.	.002	mg/l	65	65	27-107	0	30
2-Methylphenol	N.D.	.002	mg/l	82	85	58-109	5	30
4-Methylphenol	N.D.	.006	mg/l	80	79	51-105	0	30
Hexachloroethane	N.D.	.002	mg/l	52	52	8-108	0	30
Nitrobenzene	N.D.	.002	mg/l	96	98	61-120	2	30
Hexachlorobutadiene	N.D.	.004	mg/l	56	58	4-112	4	30
2,4,6-Trichlorophenol	N.D.	.004	mg/l	92	92	67-124	1	30
2,4,5-Trichlorophenol	N.D.	.004	mg/l	91	93	71-122	3	30
2,4-Dinitrotoluene	N.D.	.002	mg/l	100	101	71-123	1	30
Hexachlorobenzene	N.D.	.004	mg/l	101	104	71-127	3	30
Pentachlorophenol	N.D.	.006	mg/l	87	90	36-133	4	30
Batch number: 010520007A	Sample number(s): 3554014							
C6 - C10 Hydrocarbons	N.D.	8.	mg/kg	87	93	70-130	7	30
>C10 - C28 Hydrocarbons	N.D.	8.	mg/kg	85	93	70-130	9	30
Total C6 - C28 Hydrocarbons	N.D.	20.	mg/kg	86	93	70-130	8	30
Batch number: 010525705004	Sample number(s): 3554015							
Arsenic	-0.00347J	.032	mg/l	99	99	90-110	0	20
Selenium	-0.00151J	.06	mg/l	99	100	90-110	1	20
Barium	-0.00003J	.0017	mg/l	99	99	95-110	0	20
Cadmium	N.D.	.0036	mg/l	102	102	94-110	1	20
Chromium	-0.00004J	.0066	mg/l	102	102	95-110	0	20
Lead	N.D.	.03	mg/l	101	100	94-110	0	20
Silver	-0.00061J	.0036	mg/l	101	103	94-110	1	20

Sample Matrix Quality Control

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 010511022010A	Sample number(s): 3554014								
Total Cyanide (solid)	109		75-125			N.D.	N.D.	20 (1)	20

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

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Quality Control Summary

Client Name: McCulley Frick & Gilman, Inc. Group Number: 751215
Reported: 03/02/01 at 02:37 PM

Sample Matrix Quality Control

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 010515713001	Sample number(s): 3554015								
Mercury	81	80	80-120	1	20	N.D.	N.D.	8 (1)	20
Batch number: 01051820002A	Sample number(s): 3554014								
Moisture						27.482945	27.616778	0	16
Batch number: 010520007A	Sample number(s): 3554014								
C6 - C10 Hydrocarbons	71	78	70-130	8	30				
>C10 - C28 Hydrocarbons	36*	50*	70-130	25	30				
Total C6 - C28 Hydrocarbons	53*	64*	70-130	16	30				
Batch number: 010525705004	Sample number(s): 3554015								
Arsenic	100	99	82-122	1	20	N.D.	N.D.	0 (1)	20
Selenium	99	98	80-125	1	20	N.D.	N.D.	0 (1)	20
Barium	98	98	90-109	0	20	0.02849	0.02903	2 (1)	20
Cadmium	100	100	83-113	0	20	N.D.	N.D.	0 (1)	20
Chromium	103	101	89-117	1	20	N.D.	N.D.	0 (1)	20
Lead	99	99	77-123	0	20	N.D.	N.D.	0 (1)	20
Silver	102	100	82-127	1	20	N.D.	N.D.	0 (1)	20

Surrogate Quality Control

Analysis Name: TCLP Acid Base/Neutrals
Batch number: 01051WAD026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	Phenol-d6
3554015	97	80	84	40
Blank	97	76	90	40
LCS	100	85	96	43
LCSD	104	85	97	43
Limits:	52-136	59-117	41-139	10-89

	2-Fluorophenol	2,4,6-Tribromophenol
3554015	61	87
Blank	61	90
LCS	65	95
LCSD	64	96
Limits:	15-105	35-147

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

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Quality Control Summary

Client Name: McCulley Frick & Gilman, Inc. Group Number: 751215
Reported: 03/02/01 at 02:37 PM

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

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ANALYTICAL RESULTS

Prepared for:

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

SAMPLE GROUP

The sample group for this submittal is 751215. Samples arrived at the laboratory on Saturday, February 17, 2001. The PO# for this group is 020073.

Client Description	Lancaster Labs Number
WPD-4C (1.5-2.5) Composite Soil Sample	3554014
WPD-4C (1.5-2.5) Composite Soil Sample	3554015

METHODOLOGY

The specific methodologies used in obtaining the enclosed analytical results are indicated on the laboratory chronicles.

2 COPIES TO   McCulley Frick & Gilman, Inc.   Attn: Mr. Kaveh Khorzad

Questions? Contact your Client Services Representative
Kathy Klinefelter at (717) 656-2300.

Respectfully Submitted,

Christine M. Ratcliff

Christine M. Ratcliff
Sr. Chemist/Coordinator

Lancaster Laboratories
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Lancaster Laboratories Sample No. SW 3554014

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

WPD46

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit	Units	Dilution Factor
00111	Moisture	n.a.	27.482945	0.50	% by wt.	1
	"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The result reported above is on an as-received basis.					
05895	Total Cyanide (solid)	57-12-5	0.120355J	0.25	mg/kg	1
08750	TX Method 1005 - TPH (soils)					
08751	C6 - C10 Hydrocarbons	n.a.	N.D.	11.	mg/kg	1
08752	>C10 - C28 Hydrocarbons	n.a.	44.942692	11.	mg/kg	1
08753	Total C6 - C28 Hydrocarbons	n.a.	44.942692	28.	mg/kg	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00111	Moisture	EPA 160.3 modified	1	02/20/2001 17:41	Justin M. Bowers	1
05895	Total Cyanide (solid)	SW-846 9012A	1	02/20/2001 15:24	Matthew J. Mercer	1
08750	TX Method 1005 - TPH (soils)	TNRCC TX 1005, 4/98	1	02/22/2001 17:13	Matthew S. Thomas	1
05896	Cyanide Solid Distillation	SW846 9012A, mod.	1	02/20/2001 11:35	Cheryl L. Robinson	1
07004	Extraction - DRO (Soils)	TNRCC TX 1005, 04/98	1	02/21/2001 11:00	John M. Becker	1

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Lancaster Laboratories Sample No. TL 3554015

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
TCLP NON-VOLATILE EXTRACTION
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

NV-46

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	0.000026J	0.00012	mg/l	1

The metal analyses were performed on a non-volatile leachate prepared according to the procedure specified in SW-846, Chapter 7.4 (Revision 3, December, 1994). A sample is considered to have failed the Toxicity Characteristic (TC) test and is considered a hazardous waste if any of the metal concentrations (mg/l) in the leachate exceed the following maxima (100 times the Primary Drinking Water Standards):

Arsenic	5.0	Cadmium	1.0	Lead	5.0	Selenium	1.0
Barium	100.0	Chromium	5.0	Mercury	0.2	Silver	5.0

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
01335	Arsenic	7440-38-2	0.01161J	0.032	mg/l	1
01336	Selenium	7782-49-2	0.00376J	0.050	mg/l	1
01746	Barium	7440-39-3	0.66844	0.0017	mg/l	1
01749	Cadmium	7440-43-9	0.00192J	0.0036	mg/l	1
01751	Chromium	7440-47-3	0.00189J	0.0066	mg/l	1
01755	Lead	7439-92-1	0.01968J	0.030	mg/l	1
01766	Silver	7440-22-4	-0.00127J	0.0036	mg/l	1
00949	TCLP Acid Base/Neutrals					
03324	Pyridine	110-86-1	N.D.	0.0040	mg/l	1
03325	1,4-Dichlorobenzene	106-46-7	N.D.	0.0020	mg/l	1
03326	2-Methylphenol	95-48-7	N.D.	0.0020	mg/l	1
03327	4-Methylphenol	106-44-5	N.D.	0.0060	mg/l	1

3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
03328	Hexachloroethane	67-72-1	N.D.	0.0020	mg/l	1
03329	Nitrobenzene	98-95-3	N.D.	0.0020	mg/l	1
03330	Hexachlorobutadiene	87-68-3	N.D.	0.0040	mg/l	1
03331	2,4,6-Trichlorophenol	88-06-2	N.D.	0.0040	mg/l	1
03332	2,4,5-Trichlorophenol	95-95-4	N.D.	0.0040	mg/l	1
03333	2,4-Dinitrotoluene	121-14-2	N.D.	0.0020	mg/l	1
03334	Hexachlorobenzene	118-74-1	N.D.	0.0040	mg/l	1
03335	Pentachlorophenol	87-86-5	N.D.	0.0060	mg/l	1

Lancaster Laboratories
Where quality is a science.

Lancaster Laboratories Sample No. TL 3554015

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
TCLP NON-VOLATILE EXTRACTION
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

NV-46

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor

The semivolatile analyses were performed on a non-volatile toxicity characteristic leachate of the submitted waste. The leachate was prepared according to the procedure specified in SW-846, Chapter 7.4 (Revision 3, 12/94). If the TCLP extract contains any one of the Toxicity Characteristic (TC) constituents in an amount equal to or exceeding the concentrations specified in 40 CFR part 261.24, the waste possesses the characteristic of toxicity and is a hazardous waste. These limits are listed below in mg/L. Other limits may apply for analyses performed under other regulations.

Total Methylphenols	200.0	Nitrobenzene	2.0
1,4-Dichlorobenzene	7.5	Pentachlorophenol	100.0
2,4-Dinitrotoluene	0.13	Pyridine	5.0
Hexachlorobenzene	0.13	2,4,5-Trichlorophenol	400.0
Hexachlorobutadiene	0.5	2,4,6-Trichlorophenol	2.0
Hexachloroethane	3.0		

Sufficient sample volume was not available to perform a MS/MSD for this analysis. Therefore, a LCS/LCSD was performed to demonstrate precision and accuracy at a batch level.

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	02/21/2001 09:27	Damary S. Valentin	1
01335	Arsenic	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01336	Selenium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01746	Barium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01749	Cadmium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01751	Chromium	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01755	Lead	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
01766	Silver	SW-846 6010B	2	02/22/2001 01:57	David K. Beck	1
00949	TCLP Acid Base/Neutrals	SW-846 8270C	1	02/21/2001 14:44	Mark A. Ratcliff	1
00947	TCLP Non-volatile Extraction	SW-846 1311	1	02/19/2001 13:00	Minerva Diaz	n.a.
04731	TCLP Leachate Extraction	SW-846 3510C	1	02/20/2001 17:00	Desiree J. Wann	1

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Lancaster Laboratories Sample No. TL 3554015

Collected:02/15/2001 10:00 by KK

Account Number: 10243

Submitted: 02/17/2001 10:30
Reported: 03/02/01 at 02:37 PM
Discard: 5/2/01
WPD-4C (1.5-2.5) Composite Soil Sample
TCLP NON-VOLATILE EXTRACTION
ALCOA - Witco 020073-1

McCulley Frick & Gilman, Inc.
4807 Spicewood Springs Road
Building IV, First Floor
Austin TX 78759-8444

NV-46

05705	WW/TL SW 846 ICP Digest (tot)	SW-846 3010A	1	02/20/2001 15:30	Liana C. Jones	1
05705	WW/TL SW 846 ICP Digest (tot)	SW-846 3010A	2	02/21/2001 15:15	Liana C. Jones	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	02/20/2001 20:39	Nelli S. Markaryan	1

Analysis Report

Lancaster Laboratories
Where quality is a science

Quality Control Summary

Client Name: McCulley Frick & Gilman, Inc. Group Number: 751215
Reported: 03/02/01 at 02:37 PM

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 01051102201A	Sample number(s): 3554014							
Total Cyanide (solid)	N.D.	.18	mg/kg	105	108	89-110	3	20
Batch number: 010515713001	Sample number(s): 3554015							
Mercury	N.D.	.00012	mg/l	107	102	84-124	5	20
Batch number: 01051820002A	Sample number(s): 3554014							
Moisture				100	100	99-101	0	4
Batch number: 01051WAD026	Sample number(s): 3554015							
Pyridine	N.D.	.004	mg/l	60	59	21-107	2	30
1,4-Dichlorobenzene	N.D.	.002	mg/l	65	65	27-107	0	30
2-Methylphenol	N.D.	.002	mg/l	82	85	58-109	5	30
4-Methylphenol	N.D.	.006	mg/l	80	79	51-105	0	30
Hexachloroethane	N.D.	.002	mg/l	52	52	8-108	0	30
Nitrobenzene	N.D.	.002	mg/l	96	98	61-120	2	30
Hexachlorobutadiene	N.D.	.004	mg/l	56	58	4-112	4	30
2,4,6-Trichlorophenol	N.D.	.004	mg/l	92	92	67-124	1	30
2,4,5-Trichlorophenol	N.D.	.004	mg/l	91	93	71-122	3	30
2,4-Dinitrotoluene	N.D.	.002	mg/l	100	101	71-123	1	30
Hexachlorobenzene	N.D.	.004	mg/l	101	104	71-127	3	30
Pentachlorophenol	N.D.	.006	mg/l	87	90	36-133	4	30
Batch number: 010520007A	Sample number(s): 3554014							
C6 - C10 Hydrocarbons	N.D.	8.	mg/kg	87	93	70-130	7	30
>C10 - C28 Hydrocarbons	N.D.	8.	mg/kg	85	93	70-130	9	30
Total C6 - C28 Hydrocarbons	N.D.	20.	mg/kg	86	93	70-130	8	30
Batch number: 010525705004	Sample number(s): 3554015							
Arsenic	-0.00347J	.032	mg/l	99	99	90-110	0	20
Selenium	-0.00151J	.06	mg/l	99	100	90-110	1	20
Barium	-0.00003J	.0017	mg/l	99	99	95-110	0	20
Cadmium	N.D.	.0036	mg/l	102	102	94-110	1	20
Chromium	-0.00004J	.0066	mg/l	102	102	95-110	0	20
Lead	N.D.	.03	mg/l	101	100	94-110	0	20
Silver	-0.00061J	.0036	mg/l	101	103	94-110	1	20

Sample Matrix Quality Control

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 01051102201A	Sample number(s): 3554014								
Total Cyanide (solid)	109		75-125			N.D.	N.D.	20 (1)	20

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

MEMBER ACIL
Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax: 717-656-2681

Lancaster Laboratories
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Quality Control Summary

Client Name: McCulley Frick & Gilman, Inc. Group Number: 751215
Reported: 03/02/01 at 02:37 PM

Sample Matrix Quality Control

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 010515713001	Sample number(s): 3554015								
Mercury	81	80	80-120	1	20	N.D.	N.D.	8 (1)	20
Batch number: 01051820002A	Sample number(s): 3554014								
Moisture						27.482945	27.616778	0	16
Batch number: 010520007A	Sample number(s): 3554014								
C6 - C10 Hydrocarbons	71	78	70-130	8	30				
>C10 - C28 Hydrocarbons	36*	50*	70-130	25	30				
Total C6 - C28 Hydrocarbons	53*	64*	70-130	16	30				
Batch number: 010525705004	Sample number(s): 3554015								
Arsenic	100	99	82-122	1	20	N.D.	N.D.	0 (1)	20
Selenium	99	98	80-125	1	20	N.D.	N.D.	0 (1)	20
Barium	98	98	90-109	0	20	0.02849	0.02903	2 (1)	20
Cadmium	100	100	83-113	0	20	N.D.	N.D.	0 (1)	20
Chromium	103	101	89-117	1	20	N.D.	N.D.	0 (1)	20
Lead	99	99	77-123	0	20	N.D.	N.D.	0 (1)	20
Silver	102	100	82-127	1	20	N.D.	N.D.	0 (1)	20

Surrogate Quality Control

Analysis Name: TCLP Acid Base/Neutrals
Batch number: 01051WAD026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	Phenol-d6
3554015	97	80	84	40
Blank	97	76	90	40
LCS	100	85	96	43
LCSD	104	85	97	43
Limits:	52-136	59-117	41-139	10-89

	2-Fluorophenol	2,4,6-Tribromophenol
3554015	61	87
Blank	61	90
LCS	65	95
LCSD	64	96
Limits:	15-105	35-147

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

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Where quality is a science.

Quality Control Summary

Client Name: McCulley Frick & Gilman, Inc. Group Number: 751215
Reported: 03/02/01 at 02:37 PM

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories
Where quality is a science.

For Lancaster Laboratories use only
Acct. # 10243 Sample # 3554014-5

Please print. Instructions on reverse side correspond with circled numbers.

(1)
Client: MFG Acct. #:
Project Name/#: Alco Witco / 020073-1 PWSID #:
Project Manager: Matt Wickham P.O. #
Sampler: Kaveh Khorzad Quote #
Name of state where samples were collected: TX

For lab use only
FSC:
SCR #: 1149048

(2)

Sample Identification	Date Collected	Time Collected	Grab (3)	Composite	Soil (Matrix 4)	Water ☐ Potable ☐ NPDES (Check if applicable)	Other	Total # of Containers	TCLP Semi-Vol (1) (Analyses Requested 5)	TCLP Metals (2)	Total CN (3)	TPH TX 1005 (4)					Remarks	Temperature of samples upon receipt (if requested) (6)
WPD-4C (1.5-3.5)	2-15-01	1000		X	X			1									Please run analysis in order of importance (1,2,3,4)	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax
Phone #: Fax #:

(8) **Data Package Options** (please circle if requested)
QC Summary Type VI (Raw Data)
Type I (Tier I) GLP
Type II (Tier II) Other
Type III (NJ Red. Del.)
Type IV (CLP)

SDG Complete? Yes No

Site-specific QC required? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal Chain of Custody required? Yes No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	2-9-01	0930			
[signature]	2-16-01	1530			
			T. Carlson	2/17/01	1030

APPENDIX C

Geotechnical Data

T.S.I. LABORATORIES

TRINITY SOILS INVESTIGATION
1810 SOUTH LAURENT
VICTORIA, TEXAS 77901

Telephone 361-578-6933
Toll Free 1-866-TSI-LABS
Email tsilab@txcr.net

March 20, 2001

McCulley, Frick & Gilman, Inc.
8900 Business Park Drive
Austin, Texas 78759
Attn: Mr. Dan Bullock

File No.: M-1155-01
Lab No.: T-11089

Re: WITCO Predesign Project – Project No. 020073

Dear Mr. Bullock,

The samples for the above referenced project were delivered to TSI Laboratories on February 28, 2001 by Mr. Travis Hanna of McCulley, Frick & Gilman. Laboratory tests were completed as requested. However, some of the requested tests could not be performed, due to disturbed samples that were not suitable for analysis.

If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully submitted,
T.S.I. Laboratories

Michael Tater

MST/lre

T.S.I. LABORATORIES

1810 SOUTH LAURENT
VICTORIA, TEXAS 77901
(361)578-6933

SUMMARY OF LABORATORY TEST RESULTS

ROJECT: WITCO Predesign Project
Project No. 020073

FILE NO: M-1155-01
LAB NO: T-11089
DATE: 3/20/01

LIENT: McCulley, Frick & Gilman

Boring Number	Depth, feet	Material Description and Classification	Liquid Limit	PI %	Moisture Content	Dry Unit Weight pcf	Amt of soil finer than #200 sieve	Hydraulic Conductivity cm/sec	Unconfined Strength tsf
WPD-5	8-9'	Greenish gray sandy fat clay (CH)	52	34	27.0		65.7		
WPD-5	16-18'	Red, yellowish brown, and gray mixed clay (CH)			31.2	79.2		3.4E-09	0.5
WPD-10	18-20'	Brown silty clayey sand (SC-SM)	23	7	23.5		43.1		
WPD-10	19.6-20'	Brown silty clayey sand (SC-SM)	22	6	26.3		44.4		

EMARKS:

CHAIN-OF-CUSTODY RECORD AND REQUEST FOR ANALYSIS

McCULLEY, FRICK & GILMAN, INC.

№ 30812
COC No.

- ☐ Albuquerque Office, 8100 Mountain Road NE, Suite 210, Albuquerque, NM 87110, TEL: (505) 266-8880, FAX: (505) 266-8881
- X Austin Office, 8900 Business Park Dr., Austin, TX 78759, TEL: (512) 338-1667, FAX: (512) 338-1331
- ☐ Boston Office, 500 W Cummings Park, Suite #1050, Woburn, MA 01801, TEL: (781) 937-0500, FAX: (781) 937-0578
- ☐ Pittsburgh Office, 800 Vinial Street, Suite #B408, Pittsburgh, PA 15212, TEL: (412) 321-2278, FAX: (412) 321-2283
- ☐ Iselin Office, 33 Wood Avenue South, Suite 600, Iselin, NJ 08830, TEL: (732) 603-5528, FAX: (732) 603-5240
- ☐ Port Lavaca Office, 320 E. Main, Port Lavaca, TX 77979, TEL: (512) 552-8839, FAX: (512) 553-6115
- ☐

PROJECT NO.: 220073 PROJECT NAME: Waco Pre-Design PAGE: 1 OF: 1

SAMPLER (Signature): [signature] PROJECT MANAGER: Dan Bullock DATE: 2-27-01

METHOD OF SHIPMENT: Hand CARRIER/WAYBILL NO.: — DESTINATION:

SAMPLES													ANALYSIS REQUEST									
	Sample			Preservation						Containers			Constituents/Method					Handling			Remarks
Field Sample Identification	DATE	TIME	Matrix*	HCl	HNO_3	H_2SO_4	COLD		FILTRATION*	VOLUME (ml/oz)	TYPE*	NO.	Soil Classification					HOLD	RUSH	STANDARD	
WPD-15 (8-9)	2-22-01	1600	SO							500ml	G	1	X								

TOTAL NUMBER OF CONTAINERS

LABORATORY COMMENTS/CONDITION OF SAMPLES Cooler Temp:

RELINQUISHED BY:					RECEIVED BY:		
SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME	SIGNATURE	PRINTED NAME	COMPANY
[signature]	Travis Hanna	MFG	2-28-01	2:55pm	Tom B[signature]	Tom Baez	TSI
							LABORATORY

*KEY: Matrix: AQ - aqueous NA - nonaqueous SO - soil SL - sludge P - petroleum A - air OT - other Containers: P - plastic G - glass T - teflon B - brass OT - other Filtration: F - filtered U - unfiltered

DISTRIBUTION: PINK: Field Copy YELLOW: Laboratory Copy WHITE: Return to Originator

CHAIN-OF-CUSTODY RECORD AND REQUEST FOR ANALYSIS

McCULLEY, FRICK & GILMAN, INC.

№ 30813
COC No. ______

☐ Albuquerque Office
8100 Mountain Road NE
Suite 210
Albuquerque, NM 87110
TEL: (505) 266-8880
FAX: (505) 266-8881

☒ Austin Office
8900 Business Park Dr.
Austin, TX 78759
TEL: (512) 338-1667
FAX: (512) 338-1331

☐ Boston Office
500 W Cummings Park
Suite #1050
Woburn, MA 01801
TEL: (781) 937-0500
FAX: (781) 937-0578

☐ Pittsburgh Office
800 Vinial Street
Suite #B408
Pittsburgh, PA 15212
TEL: (412) 321-2278
FAX: (412) 321-2283

☐ Iselin Office
33 Wood Avenue
South, Suite 600
Iselin, NJ 08830
TEL: (732) 603-5528
FAX: (732) 603-5240

☐ Port Lavaca Office
320 E. Main
Port Lavaca, TX 77979
TEL: (512) 552-8839
FAX: (512) 553-6115

☐ ______

PROJECT NO.: 020073 PROJECT NAME: Wilco Pre Design PAGE: 1 OF: 1

SAMPLER (Signature): Kevin Khazeed PROJECT MANAGER: Don Bullock DATE: 2-13-01

METHOD OF SHIPMENT: Hand CARRIER/WAYBILL NO.: ______ DESTINATION: ______

SAMPLES													ANALYSIS REQUEST								
	Sample			Preservation						Containers			Constituents/Method					Handling			Remarks
Field Sample Identification	DATE	TIME	Matrix*	HCl	HNO_3	H_2SO_4	COLD		FILTRATION*	VOLUME (ml/oz)	TYPE*	NO.	Unconfined Compressive Strength Test	Unit Weight	Moisture Content	Permeability	Soil Classification	HOLD	RUSH	STANDARD	
WPD-5 (16-18)	2-13-01	1115	SO									1	X	X	X	X					(16.2-18 ft)
WPD-10 (18-20)	2-14-01	1200	SO									1	X	X	X						(18-19.8 ft)
↓	↓	↓	↓														X				19.8-20 ft

TOTAL NUMBER OF CONTAINERS

LABORATORY COMMENTS/CONDITION OF SAMPLES Cooler Temp:

RELINQUISHED BY:					RECEIVED BY:		
SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME	SIGNATURE	PRINTED NAME	COMPANY
[signature]	Travis Evans	MFG	2-28-01	2:55pm	Tom Paez	Tom PAEZ	TSI
							LABORATORY

*KEY: Matrix: AQ - aqueous NA - nonaqueous SO - soil SL - sludge P - petroleum A - air OT - other Containers: P - plastic G - glass T - teflon B - brass OT - other Filtration: F - filtered U - unfiltered

DISTRIBUTION: PINK: Field Copy YELLOW: Laboratory Copy WHITE: Return to Originator

APPENDIX D

Wetland Survey Results

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Alcoa / Witco Applicant/Owner: Investigator: Travis Hanna	Date: 7-10-00 County: Calhoun State: TX
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: Transect ID: 1 Plot ID: 4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Borrichia frutescens	H	FacW+	9.		
2.			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 1/1 100%

Remarks:

FAC-neutral 1 wet

HYDROLOGY

__ Recorded Data (Describe in Remarks): __ Stream, Lake, or Tide Gauge __ Aerial Photographs __ Other ✓ No Recorded Data Available Field Observations: Depth of Surface Water: None (in.) Depth to Free Water in Pit: 12 (in.) Depth to Saturated Soil: 6 (in.)	Wetland Hydrology Indicators: Primary Indicators: __ Inundated ✓ Saturated in Upper 12 Inches __ Water Marks ✓ Drift Lines __ Sediment Deposits __ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): __ Oxidized Root Channels in Upper 12 Inches __ Water-Stained Leaves __ Local Soil Survey Data ✓ FAC-Neutral Test __ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): Ijam Clay

Drainage Class: VPD

Field Observations
Confirm Mapped Type? Yes **No**

Taxonomy (Subgroup): Vertic Fluvaquents

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR5/4	—	—	FSL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ✓ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes **No** (Circle)
Wetland Hydrology Present? Yes **No**
Hydric Soils Present? Yes **No**

(Circle)
Is this Sampling Point Within a Wetland? Yes **No**

Remarks:

Approved by HQUSACE 2/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Alcoa/witco Applicant/Owner: ______ Investigator: Travis Henire	Date: 7-10-00 County: Calhoun State: TX
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: ______ Transect ID: 1 Plot ID: B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Cynodon dactylon	G	FacU	9.		
2. Haplopappus divaricatus	H	FacU	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Grass
Herb

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100 %

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other ✓ No Recorded Data Available Field Observations: Depth of Surface Water: none (in.) Depth to Free Water in Pit: none (in.) Depth to Saturated Soil: none (in.)	Wetland Hydrology Indicators: Primary Indicators: ___ Inundated ___ Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ___ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Ijam Clay

Drainage Class: VPD

Field Observations Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Vertic Fluvaquents

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR4/2	—	—	FSL
6-12	A	10YR 5/3	—	—	FSL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ✓ Aquic Moisture Regime
- ✓ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)

Wetland Hydrology Present? Yes No

Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 2/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Alcoa/Wito Applicant/Owner: Investigator: Travis Henry	Date: 7-10-00 County: Calhoun State: TX
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: Transect ID: 2 Plot ID: 4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Zanthoxylum clava-herculis	T	Fac-	9.		
2. Borrichia frutescens	H	Fach +	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Shrub

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100 %

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gauge
___ Aerial Photographs
___ Other
✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)

Depth to Free Water in Pit: none (in.)

Depth to Saturated Soil: none (in.)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
___ Saturated in Upper 12 Inches
X Water Marks
X Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 Inches
___ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): Fjam Clay

Drainage Class: UPD

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Vertic Fluvaquents

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR5/4	None	None	Sandy

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ✓ Aquic Moisture Regime
- ✓ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 2/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Alcoa / Witco Applicant/Owner: Investigator: Travis Henne	Date: 7-10-00 County: Calhoun State: TX
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: Transect ID: 3 Plot ID: 4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Distichlis spicata		FacWt	9.		
2. Borrichia frutescens		FacWt	10.		
3. Spartina Alterniflora		OBL	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100 %

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other ✓ No Recorded Data Available Field Observations: Depth of Surface Water: none (in.) Depth to Free Water in Pit: none (in.) Depth to Saturated Soil: Surface (in.)	Wetland Hydrology Indicators: Primary Indicators: ___ Inundated ✓ Saturated in Upper 12 Inches ___ Water Marks ✓ Drift Lines ___ Sediment Deposits ___ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Ijc-Clx

Drainage Class: UPD

Field Observations Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Vertic Fluvaquents

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR 3/3	10YR 5/8	—	FSL
6-	A	10YR 4/3	—	—	FSL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)

Wetland Hydrology Present? Yes No

Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 2/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Alcoa/ Witco Applicant/Owner: _____ Investigator: Travis Henning	Date: 7-10-00 County: Calhoun State: TX
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: _____ Transect ID: 3 Plot ID: B

VEGETATION

	Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
shrub	1. Prosopis juliflora	S	FacU-	9.		
bush	2. Haplopappus divaricatus	B	FacU	10.		
grass	3. Cynodon dactylon	G	FacU	11.		
	4.			12.		
	5.			13.		
	6.			14.		
	7.			15.		
	8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks:

HYDROLOGY

__ Recorded Data (Describe in Remarks):
__ Stream, Lake, or Tide Gauge
__ Aerial Photographs
__ Other
✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)

Depth to Free Water in Pit: none (in.)

Depth to Saturated Soil: none (in.)

Wetland Hydrology Indicators:

Primary Indicators:
__ Inundated
__ Saturated in Upper 12 Inches
__ Water Marks
__ Drift Lines
__ Sediment Deposits
__ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
__ Oxidized Root Channels in Upper 12 Inches
__ Water-Stained Leaves
__ Local Soil Survey Data
__ FAC-Neutral Test
__ Other (Explain in Remarks)

Remarks:

Entisol

SOILS

Map Unit Name
(Series and Phase): Ijam Clay

Drainage Class: VPD

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Vertic Fluvaquents

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12	A	10YR 4/2	—	—	FSL
12-	A	10YR 5/2	—	—	SC

Sandy. Clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ✓ Aquic Moisture Regime
- ✓ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 2/92

UPDATE TO WITCO AREA SOILS REMEDIAL DESIGN REPORT AND OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix E2 to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Remedial Design Report (RDR) and Operations, Maintenance, and Monitoring Plan (OMMP) for Witco Area Soils from September 2003.[1] Maintenance and monitoring of the Witco Area Soils remedial actions are conducted in accordance with the original RDR and OMMP. Periodic inspections will occur semiannually and also on an as-requested or as-needed basis.

[1] Alcoa, 2003. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.

Witco Area Soils

Remedial Design Report and

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

September 2003

ALCOA

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document represents the Remedial Design Report (RDR) and associated Operations, Monitoring, and Maintenance Plan (OMMP) for the Witco Area soil remedy at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site in Point Comfort, Texas. Two potential source areas (PSAs) at the Witco Area (Stormwater Sump and Separator Area and the Former Coal Tar Tank Farm Area) were identified as “hot spots” since the level of polyaromatic hydrocarbons (PAHs) measured in these areas were greater than the other PSAs at the Witco Area. Based on the elevated PAH concentrations and the fact that the estimated carcinogenic risks due to PAHs at these PSAs was near the upper end of EPA’s target risk range, capping of surface soils at these two PSAs was recommended in the Feasibility Study (FS) (Alcoa, 2001). This document presents an overview of the soil remedy, the objectives of the remedial and monitoring program, and other considerations. This RDR/OMMP is one of a series of RDRs and OMMPs that collectively provide the design for the entire Site remedy as defined in the Record of Decision (ROD) (EPA, 2001). These reports have been prepared as attachments to the Consent Decree.

1.2 SITE DESCRIPTION

The Site is defined in the Administrative Order on Consent (AOC) and in the Project Management Plan (PMP) (Alcoa, 1996). Specifically, the areas covered by this RDR are the Stormwater Sump and Separator Area and the Former Coal Tar Tank Farm Area, located in the Witco Area on the western portion of the PCO facility near the Lavaca Bay shoreline (Figure 1-1). A detailed description of the historical operations at the Witco Area is contained in the *Preliminary Site Characterization Report* (PSCR) (Alcoa, 1995). Surface soils in the Stormwater Sump and Separator Area and the Former Coal Tar Tank Farm Area were identified during the Remedial Investigation (Alcoa, 1999) as “hot spots” containing elevated PAH concentrations.

1.3 REMEDY OVERVIEW

The areas recommended for remediation in the FS include the Stormwater Sump and Separator Area (approximately 3,000 square feet (sf) in area) and the Former Tank Farm Area (approximately 150,000 sf in area). The approximate boundaries of these areas are shown in Figure 1-1.

In the FS, remedial action alternatives to address the Witco Area soil remedial action objective (RAO) were evaluated. Based on the results of that analysis, the recommended remedy for Witco Area soil was capping. Information related to design and construction of the cap is contained in Section 2.0. Maintenance of the cap is described in Section 3.0 of this report.

1.4 PERFORMANCE OBJECTIVES AND STANDARDS

The RAO for soils in the Witco Area is to reduce the future exposure potential of site workers to PAHs in surficial soils. The performance objective for the Witco Area soil remedy (protective cap and security devices) is to limit worker exposure to site soils by restricting worker access to the area and implementing a site-specific Health and Safety program for the area.

1.5 PLAN REVIEW AND REVISION

At the end of each calendar year, Alcoa will review the effectiveness of the OMMP in meeting the monitoring objectives. At that time, changes, which may include additions or deletions to the scope of the program, will be proposed for Agency review in an effort to better meet the objectives of the OMMP. Upon Agency acceptance, the changes will be incorporated into the OMMP for the remainder of the monitoring period, or until further changes are deemed necessary.

The procedures presented in this OMMP are based on methods that have been successful at other similar locations. Future site conditions and/or changes in technology may necessitate modifications to these procedures. Any permanent changes or temporary deviations will be documented and reported to the Agencies in a timely manner. If possible, these changes will be reported to the Agencies prior to implementation unless required in the field.

2.0 REMEDIAL DESIGN

As described in the FS, the recommended remedial alternative for the Stormwater Sump and Separator Area and the Former Tank Farm Area was construction of six-inch-thick soil caps and implementation of institutional controls requiring an industrial hygiene/worker safety program prior to excavation within these two areas. The caps would be sloped to facilitate stormwater run-off. After capping, future excavation of soils in these areas would only be permitted after a worker safety program was developed for the specific excavation activity and repair of the cap would be required after excavation. These areas would be deed recorded as containing soils with elevated PAH concentrations.

3.0 OPERATION, MAINTENANCE, AND MONITORING

The capped area will be inspected on a quarterly basis. The area will be inspected for:

- Cap integrity (e.g., signs of vehicular traffic or erosion);
- Vegetation growth;
- Signage integrity (e.g., upright and legible);
- Storm drains free of debris; and
- No equipment or waste storage.

Any items that are noted during the inspection will be addressed as soon as practicable. For example, ruts form vehicular traffic or erosion will be filled with crushed limestone and weed growth will be controlled by the application of herbicide. In addition, Alcoa will require that the management memo describing the prohibition of activities on the site be reviewed by Plant personnel and contractors on an annual basis.

4.0 ADDITIONAL OPERATIONS, MAINTENANCE, AND MONITORING CONSIDERATIONS

4.1 SCHEDULE

Monitoring of the capped areas will be initiated within one month after construction is completed and will be repeated on a quarterly basis thereafter.

4.2 HEALTH AND SAFETY AND MONITORING

A Health and Safety Plan (HSP) addressing maintenance of the capped area will be prepared and will be maintained on site at all times.

4.3 REPORTING REQUIREMENTS

The monitoring information collected as part of this OMMP will be reported to the regulatory agencies on an annual basis in the form of an annual monitoring report.

5.0 REFERENCES

Alcoa, 1995. *Preliminary Site Characterization Report for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

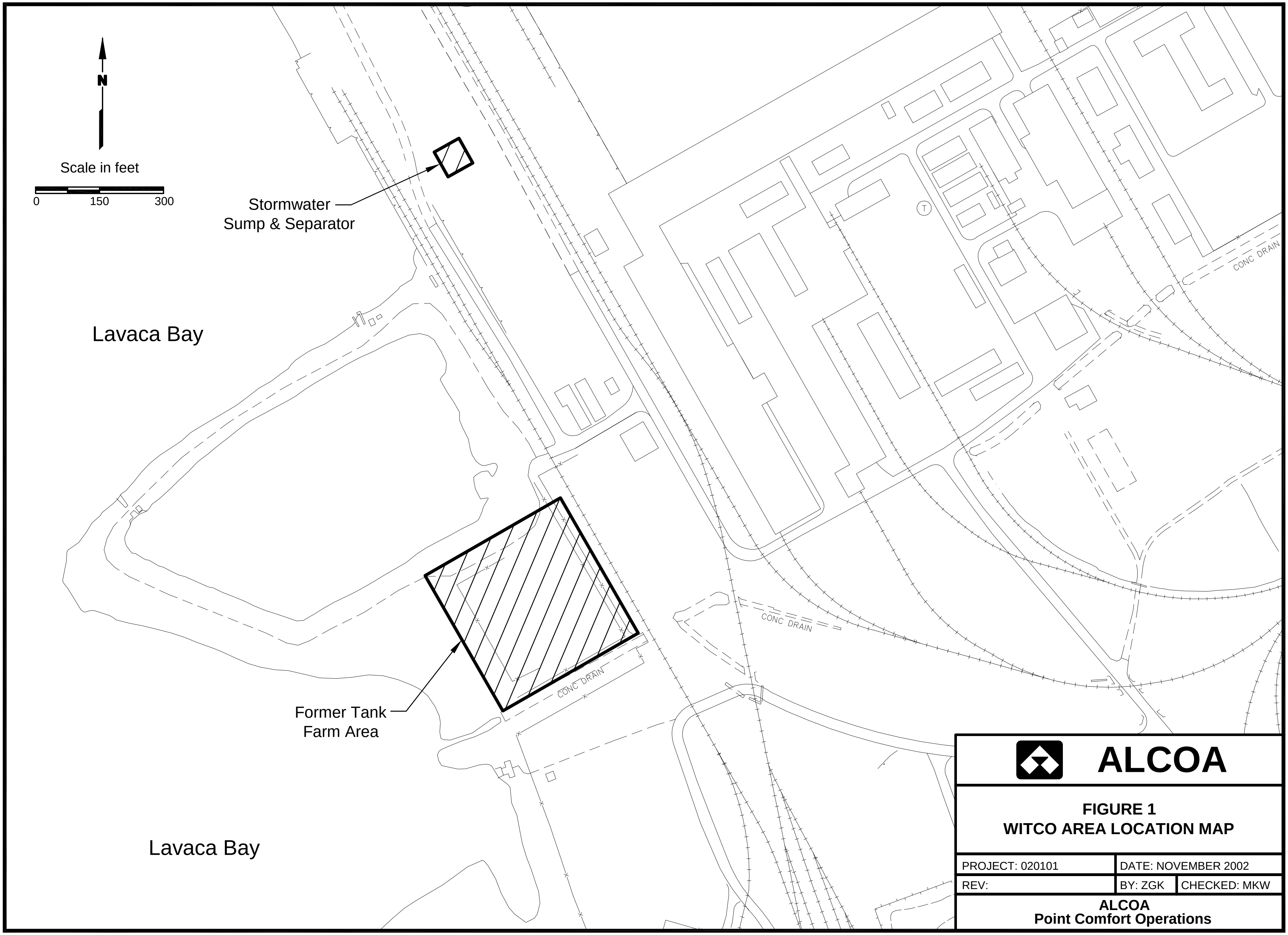
———, 1996. *Project Management Plan for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1999. *Remedial Investigation Report for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*. November.

———, 2001. *Feasibility Study Alcoa (Point Comfort)/Lavaca Bay Superfund Site.*

United States Environmental Protection Agency (EPA), 2001. Record of Decision Alcoa (Point Comfort)/Lavaca Bay Superfund Site. December.

FIGURES


N
Scale in feet
0
150
300
Stormwater
Sump & Separator
Lavaca Bay
Former Tank
Farm Area
Lavaca Bay
CONC DRAIN
CONC DRAIN
CONC DRAIN
ALCOA
FIGURE 1
WITCO AREA LOCATION MAP
PROJECT: 020101
DATE: NOVEMBER 2002
REV:
BY: ZGK
CHECKED: MKW
ALCOA
Point Comfort Operations

UPDATE TO DREDGE ISLAND OPERATIONS, MAINTENANCE, AND MONITORING PLAN

Appendix F to the *Updates to Operations, Maintenance, and Monitoring Plans for Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, dated February 2019 (main report), includes the original Operations, Maintenance, and Monitoring Plan (OMMP) for Dredge Island from September 2003.[1] Maintenance and monitoring of Dredge Island are conducted in accordance with the original OMMP. Periodic inspections will occur semi-annually and also on an as-requested or as-needed basis.

---

[1] Alcoa, 2003. *Remedial Design Report and Operations, Maintenance, and Monitoring Plan* – Appendices. September 2003.

Dredge Island

Operations, Maintenance, and Monitoring Plan

Alcoa (Point Comfort) / Lavaca Bay Superfund Site

September 2003

ALCOA

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LIST OF APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document represents the Operations, Monitoring, and Maintenance Plan (OMMP) for the Dredge Island at the Alcoa (Point Comfort)/Lavaca Bay Superfund Site in Point Comfort, Texas. Alcoa conducted a non-time critical removal action at the Dredge Island that was completed in 2001, as described below. This document presents an overview of the remedial action, the objectives of the inspection and monitoring program for Dredge Island, and other considerations. This OMMP is one of a series of RDRs and OMMPs that collectively provide the design for the entire Site remedy as defined in the Record of Decision (ROD) (EPA, 2002). These reports have been prepared as attachments to the Consent Decree.

1.2 SITE DESCRIPTION

The Site is defined in the Administrative Order on Consent (AOC) and in the Project Management Plan (PMP) (Alcoa, 1996). Specifically, the area covered by this OMMP is the Dredge Island, located west of the PCO facility in Lavaca Bay (Figures 1-1 and 1-2). Dredge Island is a discrete landform created in the late 1950's when dredge materials from dredging activities to create the Alcoa Ship Channel and the R-10 Unloading Dock were placed on a shallow reef trending north-south approximately 1000 feet west of the shoreline. Subsequent dredge activities and waste material management practices between the late 1950's and 1989 resulted in the enlargement of the footprint of the island. These activities resulted in the placement of materials on Dredge Island that contained mercury concentrations that potentially posed an unacceptable risk to human health and the environment. A detailed description of the history of Dredge Island is contained in Alcoa, 1997a.

1.3 REMEDY OVERVIEW

An Engineering Evaluation/Cost Analysis (EE/CA) for a non-time critical removal action was conducted by Alcoa for the Dredge Island in 1997 (Alcoa, 1997b). A streamlined risk evaluation, prepared as part of the EE/CA, indicated that mercury from Dredge Island could enter Lavaca Bay via erosion of mercury-contaminated soils. Based on that finding, the EE/CA documented the selection of a removal action that minimized the potential for the release of hazardous constituents from the island due to either uncontrolled erosion during normal storm events or due to the effects of more intense storms (e.g., hurricanes).

The removal action was conducted between 1998 and 2001, and is referred to as the “Dredge Island Stabilization Project.” The project included relocating the contents of the Dredge Materials Placement Areas (DMPAs) containing elevated levels of mercury (approximately 523,000 cubic yards) into the Gypsum Placement Areas (GPAs). In addition, the containment dikes surrounding the GPAs were raised so that they would not be overtopped during a design storm. This required increasing 10,700 linear feet of dike to an approximate elevation of 30 feet msl. As part of this work, the marshes on the north end of the island were removed. Erosion protection and runoff control structures were also installed on the island. A detailed description of the scope of the removal action is contained in Alcoa, 1997b. The final design and as-built drawings for the Dredge Island remedy are contained in the *Dredge Island Removal Action Plan, Volume 4 - Phase 1 Dredge Island Stabilization Completion Report*, hereafter referred to as *Volume 4* (Alcoa, 2002).

1.4 PERFORMANCE OBJECTIVES AND STANDARDS

The performance objective for the Dredge Island remedy is to interrupt the potential direct exposure pathway of contaminants in soils and sediments from Dredge Island as a result of a significant storm event or uncontrolled erosion during stormwater runoff. The removal action and reconfiguration of Dredge Island achieved this objective through engineering means, and therefore the performance objective for this OMMP is to preserve the integrity of the reconfigured island through frequent inspections and maintenance and/or repairs, as needed.

1.5 PLAN REVIEW AND REVISION

At the end of each calendar year, Alcoa will review the effectiveness of the OMMP in meeting the monitoring objectives. At that time, changes, which may include additions or deletions to the scope of the program, will be proposed for Agency review in an effort to better meet the objectives of the OMMP. Upon Agency acceptance, the changes will be incorporated into the OMMP for the remainder of the monitoring period, or until further changes are deemed necessary.

The procedures presented in this OMMP are based on methods that have been successful at other similar locations. Future site conditions and/or changes in technology may necessitate modifications to these procedures. Any permanent changes or temporary deviations will be documented and reported to the Agencies in a timely manner. If possible, these changes will be reported to the Agencies prior to implementation unless required in the field.

2.0 REMEDIAL DESIGN

The following construction activities were completed at the Dredge Island as a result of the remedial action, as illustrated on Figure 1-2:

- Construction of temporary access bridge;
- Construction of Alcoa confined disposal facility (CDF) dikes;
- Consolidation of DMPA maintenance dredge material and reconfiguration of the Calhoun County Navigational District (CCND) CDF;
- Consolidation of material outside of CDF dikes;
- Installation of two waterstops at the Alcoa CDF dike and CCND CDF dike intersections;
- Installation of two decant structures in the Alcoa CDF;
- Installation of an emergency spillway in the Alcoa CDF dike;
- Construction of dike storm protection on Alcoa's CDF;
- Construction of dike erosion protection on Alcoa's CDF; and
- Construction of a gravel road on Alcoa's CDF dikes.

The Alcoa CDF is capable of receiving additional hydraulically placed material. Subsequent dredge placement (future phases) will consist of one or more dredge events, culminating in the placement of the final cover, which will consist of hydraulically placed dredge material taken from an area of Lavaca Bay that has insignificant mercury content. After this final placement, closure and post-closure care activities will commence.

The ultimate closure of Dredge Island will include the following being implemented in the future:

- Cover - The future final cover for the Alcoa CDF may consist of dredge material, hydraulically placed, taken from an area of Lavaca Bay that has insignificant mercury content (e.g., maintenance dredging, TXDOT dredging). This placement will occur at some time in the future and is not part of Phase 1 of the Dredge Island stabilization construction project.
- Erosion Protection on the Final Cover - The future final cover will have gentle slopes so that the runoff resulting from rainfall events in the interior of the CDF will have low overland flow velocities. These low velocities will minimize the erosion of the cover material by the rainwater runoff. Additionally, a small area immediately surrounding the discharge structure will be excavated to create a

settling basin to allow ponding of the runoff prior to release. This ponding will allow suspended cover material to settle out of the runoff before it is discharged.

- Drainage Structures - The dredge decant structures will be retrofitted to function as stormwater drainage structures.

3.0 OPERATION, MAINTENANCE, AND MONITORING

Section 4 of *Volume 4* describes the components of the Phase 1 construction that require periodic inspections and maintenance, including the following:

- The access bridge from mainland to northern shore of Dredge Island;
- The 10,500 lineal feet of the Alcoa CDF containment dikes;
- The storm protection on the Alcoa CDF dike exterior, including the armor layer, underlayer, and dike toe protection;
- The gravel erosion protection on the exterior dike slopes above the armor protections and the interior dike slopes above 26.5 ft (NGVD 1929);
- The 25-ft. long concrete emergency spillway;
- The two dredge decant structures including the discharge structures;
- The two waterstops installed in the CCND CDF dikes; and
- The road on the Alcoa CDF dikes.

Volume 4 also addresses minimum inspection and maintenance procedures, and post-closure requirements to be followed throughout the active life of the Phase 1 CDF. These procedures are presented in Appendix A.

4.0 ADDITIONAL OPERATIONS, MAINTENANCE, AND MONITORING CONSIDERATIONS

4.1 SCHEDULE

A schedule for inspections of Dredge Island is provided in Appendix A. Inspections of specific components of Dredge Island will occur at varying frequencies, either monthly, quarterly, biannually, annually, after storm events or after placement of dredge material in the CDF.

4.2 HEALTH AND SAFETY AND MONITORING

A Health and Safety Plan (HSP) addressing maintenance of the capped area has been prepared and will be maintained on site at all times.

4.3 REPORTING REQUIREMENTS

The monitoring information collected as part of this OMMP will be reported to the regulatory agencies on an annual basis in the form of an annual monitoring report.

5.0 REFERENCES

Alcoa, 1996. *Project Management Plan for Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* July.

———, 1997a. *Data Report, Surface Runoff, Sediments and Groundwater Investigation, Dredge Island, Volume B5a, Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* February.

———, 1997b. *Engineering Evaluation/Cost Analysis for a Non-Time Critical Removal Action on Dredge Island, Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* March.

———, 2000. *Feasibility Study Alcoa (Point Comfort)/Lavaca Bay Superfund Site.*

———, 2002. *Dredge Island Removal Action Plan, Volume 4 - Phase 1 Dredge Island Stabilization Completion Report, Alcoa (Point Comfort)/Lavaca Bay Superfund Site.* June.

United States Environmental Protection Agency (EPA), 2002. Record of Decision, Alcoa (Point Comfort)/Lavaca Bay Superfund Site.

FIGURES

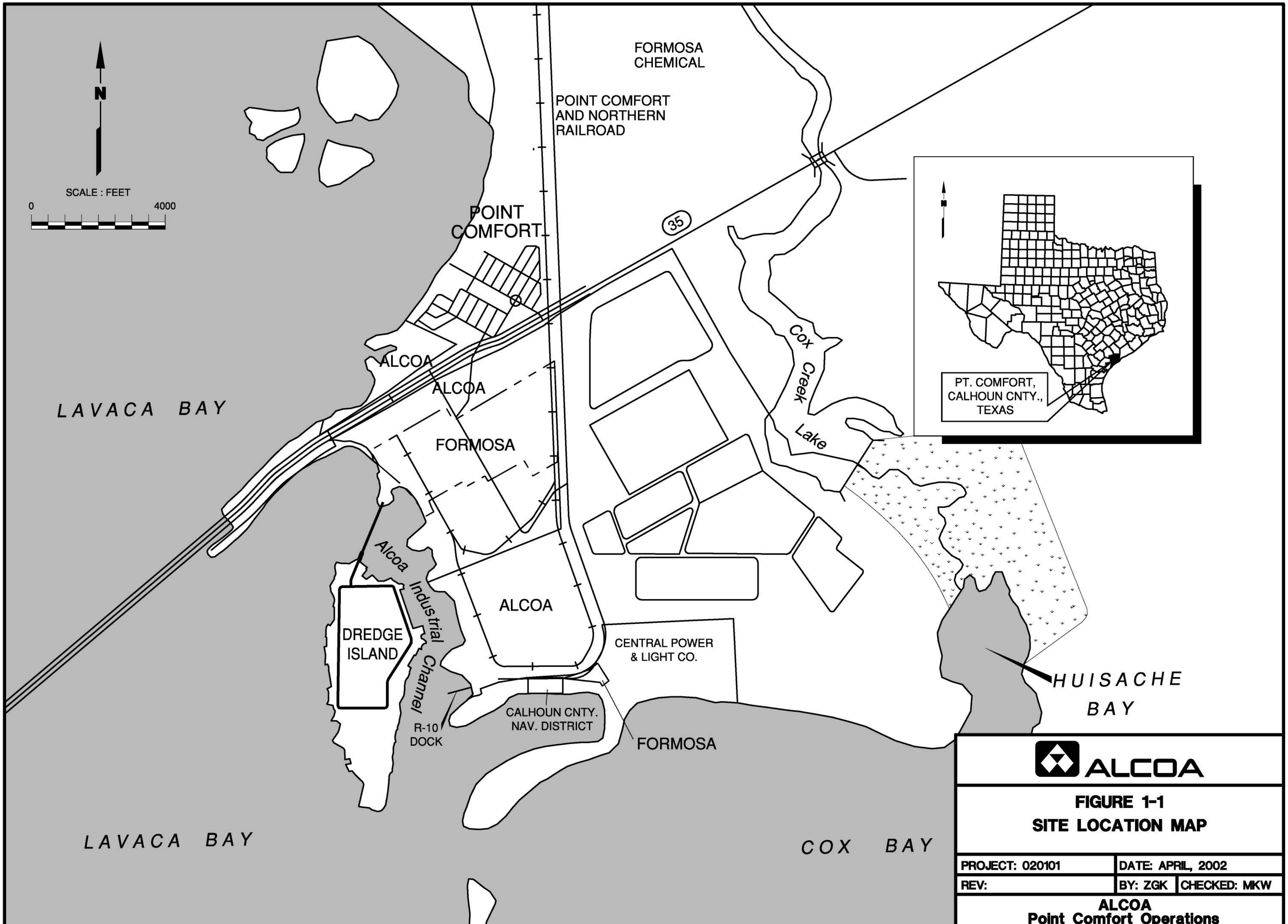
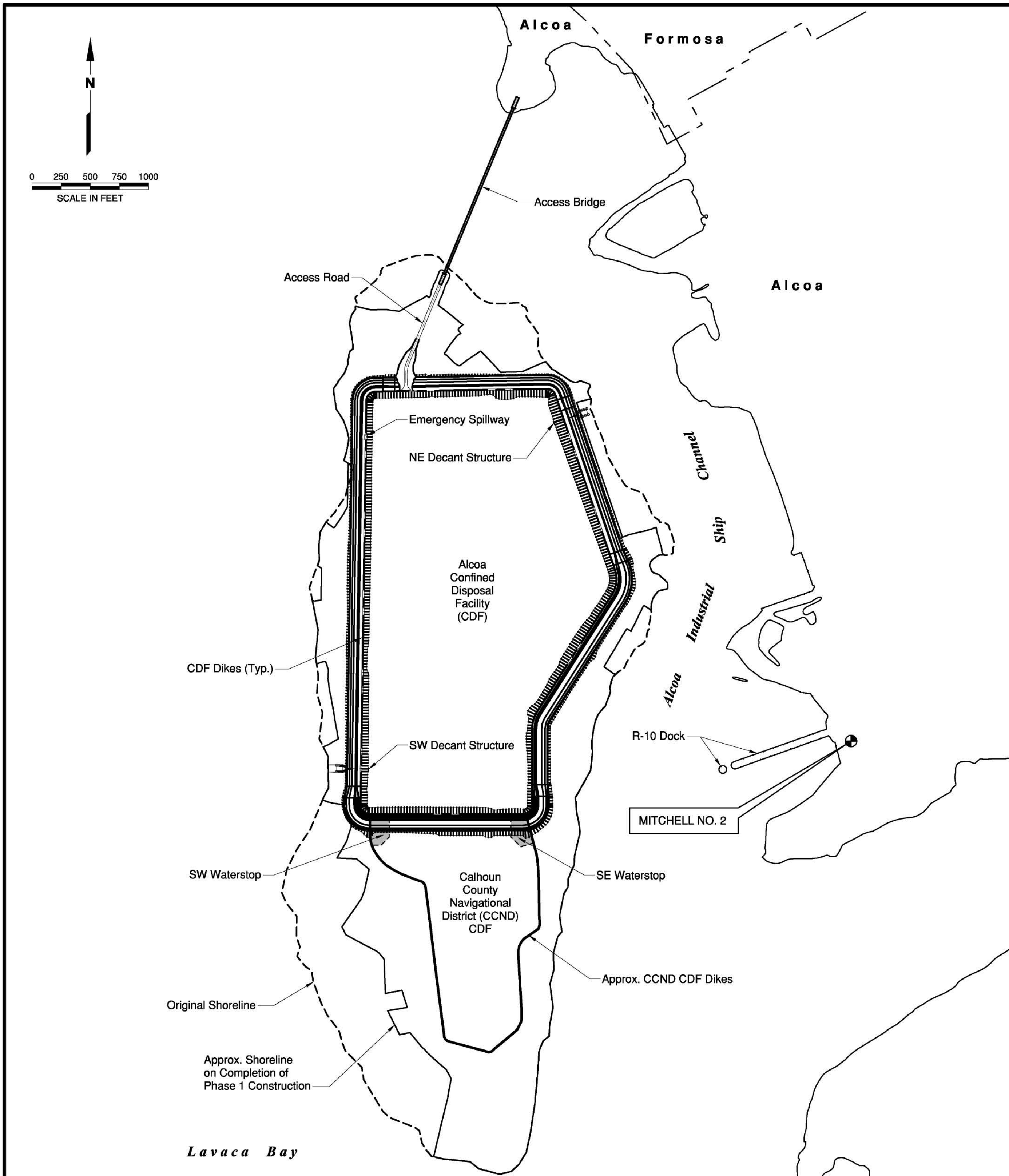


FIGURE 1-1
SITE LOCATION MAP

PROJECT: 020101	DATE: APRIL, 2002	
REV:	BY: ZGK	CHECKED: MKW

ALCOA
Point Comfort Operations



ALCOA

FIGURE 1-2
DREDGE ISLAND CURRENT CONFIGURATION

PROJECT: 020101	DATE: APRIL, 2002	
REV:	BY: ZGK	CHECKED: MKW

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APPENDICES

1.0 INTRODUCTION

This document is the *Dredge Island Removal Action Plan, Volume 4 - Phase 1 Dredge Island Stabilization Completion Report*, hereafter referred to as *Volume 4*. The Dredge Island Removal Action Plan (RAP) is a multi-volume series of documents and drawings intended to provide documentation of all appropriate design and construction activities proposed and subsequently implemented for Phase 1 of the Dredge Island Removal Action. Dredge Island is part of the Alcoa Point Comfort Operations (PCO), Lavaca Bay Superfund Site, located near Point Comfort, Texas. Dredge Island is located adjacent to, and east of, Lavaca Bay, and just offshore of the PCO facility. The location of the Alcoa PCO facility, including Dredge Island, is shown in Figure 1-1.

1.1 Purpose of Document

The purpose of *Volume 4* is to document the extent to which construction was executed in conformance with the Agency-approved drawings and specifications contained in *Dredge Island Removal Action Plan-Phase 1, Volume 3, Phase 1 Design, Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, (Alcoa, 28 May 1999) *(Drawings and Specifications)*. *Volume 4* also serves as an Operations and Maintenance Plan (O&M Plan) for Dredge Island for that period after Phase 1 construction is completed and before final closure of Dredge Island is achieved. This O&M Plan contained in *Volume 4* is considered an "interim" O&M Plan to serve during the post Phase 1 period. After final closure (see Section 1.3.4 for ultimate closure discussion) the final O&M Plan will be developed by Alcoa.

1.2 Organization of Document

Section 1 of this document contains background information on Dredge Island, and details of Phase 1 of the Dredge Island Removal Action Plan. Section 2 presents an overview of the design and functional description of key elements of the dike surrounding the Confined Disposal Facility (CDF) and the dredge decant structures. Section 3 contains as-built descriptions of the components of Phase 1 construction, and a comparison of their respective conformance to the plans and specifications. Section 4 addresses inspection and maintenance procedures, and Section 5 describes the duties and responsibilities of operations and maintenance personnel.

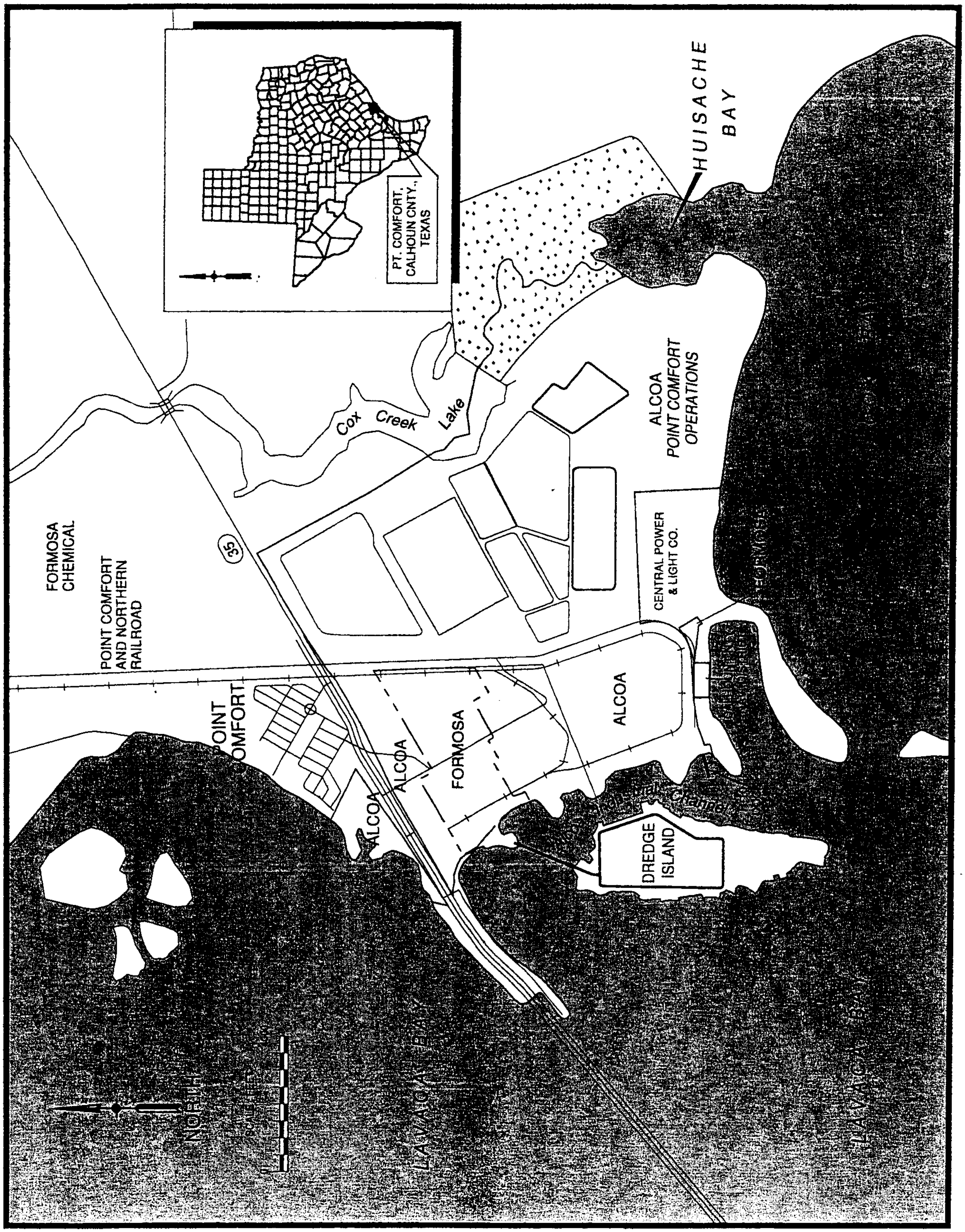

FIGURE 1-1
SITE LOCATION MAP

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Appendices are included at the end of this report to provide supporting documentation. Appendix A contains a set of half-size original design drawings for the Phase 1 Removal Action. Appendix B contains a set of half-size as-built drawings for the Phase 1 Removal Action. Appendix C contains the Problem Identification and Correction Reports that were generated during construction activities. Appendix D contains field Quality Assurance documentation. Appendix E contains soil verification sample data and dredge decant water sample data. Appendix F presents a post-closure Health and Safety Plan Template that was developed for this site.

This template is only provided for information, and should not be implemented without the involvement of a qualified health and safety professional. Appendix G contains Section 5 of the Alcoa Health and Safety Manual – Emergency Response Procedures.

1.3 Background Information

This section gives a brief description of Dredge Island, reviews the history of waste management on the Island, summarizes the regulatory actions, and summarizes the remedial design objectives.

1.3.1 Waste History

Dredge Island is located in Lavaca Bay west of Alcoa PCO and is a discrete landform initially created from dredging activities during construction of the Alcoa PCO Plant. Dredge Island later received waste material from the Alcoa facility and from channel dredging activities in the vicinity of Alcoa. The Island has been used for the management and disposal of dredge material since 1957. The East and West Gypsum Placement Areas (GPAs), shown on Figure 1-2, have been used for the disposal of gypsum, treated wastewater effluent from the Chlor-Alkali Process Area (1970), and dredge material from the Industrial Channel. Five Dredge Material Placement Areas (DMPAs) were used in 1971 and 1972 to contain maintenance dredging material removed from the Alcoa Industrial Channel. In 1984 the dredge material in DMPA 5 was relocated to the other four DMPAs.

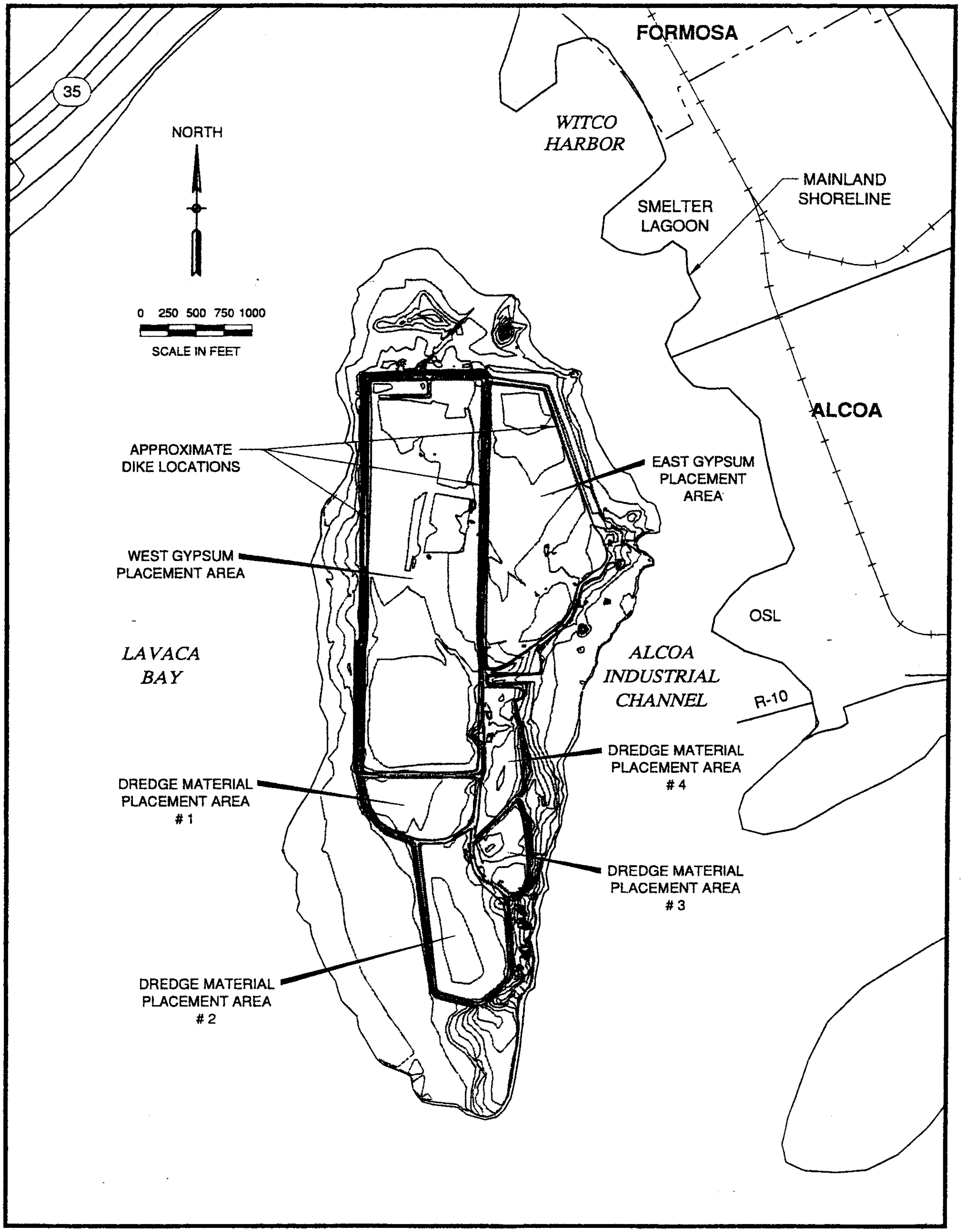


FIGURE 1-2
DREDGE ISLAND PRE-REMOVAL ACTION CONFIGURATION MAP

1.3.2 Site Description

The post-construction Island is approximately 315 acres in size, with a maximum length (north-south) of 7,770 feet, and a maximum width (east - west) of 3,050 feet. The shoreline (perimeter) of Dredge Island is approximately 21,400 feet in length. Figure 1-3 shows the current configuration of the Island and the locations of the access bridge, the CDF dike, the emergency spillway, the waterstop locations, and the dredge decant structures.

Additional detail of the Dredge Island site history, site characterization, and the nature and extent of contamination are contained in the following documents:

- Data Report - Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume B5a: Sampling and Analysis Plan - Surface Runoff, Sediment and Groundwater Investigation, *Dredge Island – Volume 1*, (Alcoa, March 1997);
- Data Report - Alcoa (Point Comfort)/Lavaca Bay Superfund Site, Volume B5a: Sampling and Analysis Plan - Surface Runoff, Sediment and Groundwater Investigation, Dredge Island – Volume 2, (Alcoa, March 1997); and
- Engineering Evaluation/Cost Analysis for a Non-Time Critical Removal Action on Dredge Island, Alcoa (Point Comfort)/Lavaca Bay Superfund Site, *(Alcoa, July 3, 1997) (referred to as the EE/CA).*

The Phase 1 Removal Action was conducted in accordance with the following agency-approved document detailing the Removal Action Plan:

- *Dredge Island Removal Action Plan-Phase 1, Volume 1, Design Basis/ARARs Analysis, Alcoa (Point Comfort)/Lavaca Bay Superfund Site,* (Alcoa, September 15, 1998);
- *Dredge Island Removal Action Plan-Phase 1, Volume 2, Material Use Plan, Alcoa (Point Comfort)/Lavaca Bay Superfund Site,* (Alcoa, September 15, 1998);
- *Dredge Island Removal Action Plan-Phase 1, Volume 3, Phase 1 Design, Alcoa (Point Comfort)/Lavaca Bay Superfund Site,* (Alcoa, 28 May 1999); and
- *Dredge Island Removal Action Plan-Phase 1, Volume 3, Phase 1 Design-Engineering Calculations, Alcoa (Point Comfort)/Lavaca Bay Superfund Site,* (Alcoa, 28 May 1999).

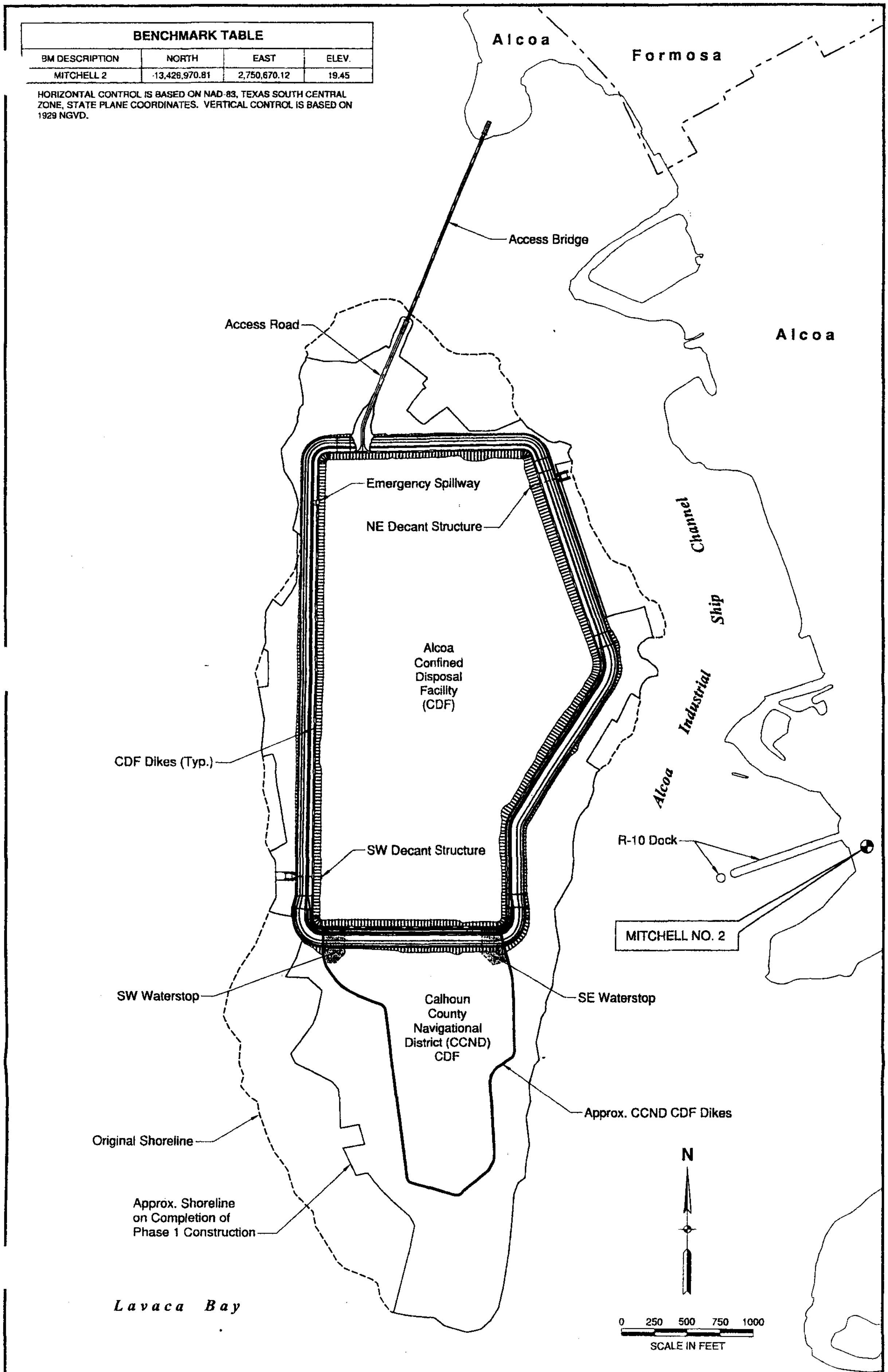


FIGURE 1-3
DREDGE ISLAND CURRENT CONFIGURATION MAP

1.3.3 Summary of Regulatory Actions

The Alcoa (PCO)/Lavaca Bay Superfund Site was placed on the National Priorities List on 23 February 1994, with an effective listing date of 25 March 1994. The Administrative Order on Consent (AOC), which was issued on 31 March 1994, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), requires that a Remedial Investigation (RI), Baseline Risk Assessment (BLRA), and a Feasibility Study (FS) be performed at the site. The AOC contains a Statement of Work (SOW) in its Attachment D detailing the requirement for the RI, BLRA, and FS. Additional regulatory background information can be found in the *Preliminary Site Characterization Report, Alcoa (Point Comfort)/Lavaca Bay Superfund Site*, (Alcoa, July 10, 1995) (referred to as the PSCR). The RI was conducted in accordance with Guidance for Conducting Report Remedial Investigations and Feasibility Studies Under CERCLA (EPA/G-89/004).

The stated purposes of the AOC/SOW are:

- To determine the nature and extent of contamination within the Study Area based on risk to human health and the environment. (The Study Area has been defined in the agency approved Project Management Plan as "the geographic area within which there is a threat or potential threat to human health, welfare, and the environment caused by the release or threatened release of hazardous substance, pollutants, or contaminants that are associated with activities at or originating from the plant or Dredge Island.");

- To determine and evaluate alternatives for remedial actions (if any) to prevent, mitigate or otherwise respond to, or remedy, any release or threatened release of hazardous substance, pollutants, or contaminants within the Study Area and within the Site, by conducting a feasibility study;

- To identify and evaluate actual or potential risks to human health and the environment by conducting a baseline risk assessment; and

- To protect public health, welfare, and the environment by carrying out removal actions that may by agreed to by the parties.

1.3.4 Summary of the Dredge Island Removal Action - Phase 1

The objectives of the Dredge Island Removal Action Plan - Phase 1 were:

- To minimize the potential for the release of contaminants from the former Gypsum Placement Areas (GPAs) and the former Dredge Material Placement Areas (DMPAs) (See Figure 1-2); and

- To minimize erosion of mercury-contaminated soils outside the dikes into Lavaca Bay as the result of a significant storm event or uncontrolled erosion during stormwater runoff.

The resultant configuration of the Dredge Island Removal Action Plan - Phase 1 is illustrated in Figure 1-3, and consists of the following:

- Construction of Timber Access Bridge;

- Construction of Alcoa CDF Dikes;

- Consolidation of DMPA Maintenance Dredge Material and Reconfiguration of the Calhoun County Navigational District (CCND) CDF;

- Consolidation of Material Outside of CDF Dikes;

- Two Waterstops installed at the Alcoa CDF Dike and CCND CDF Dike Intersections;

- Two Decant Structures installed in the Alcoa CDF;

- An Emergency Spillway installed in the Alcoa CDF Dike;

- Dike Storm Protection on Alcoa's CDF;

- Dike Erosion Protection on Alcoa's CDF; and

- Gravel Road Constructed on Alcoa's CDF Dikes.

The Alcoa CDF, as constructed during Phase 1, is capable of receiving additional hydraulically placed material. Subsequent dredge placement (future phases) will consist of one or more dredge events, culminating in the placement of the final cover, which will consist of hydraulically placed dredge material taken from an area of Lavaca Bay that has insignificant mercury content. After this final placement, closure and post-closure care activities will commence.

The ultimate closure of Dredge Island will include the following being implemented in the future:

- Cover - The future final cover for the Alcoa CDF may consist of dredge material, hydraulically placed, taken from an area of Lavaca Bay that has insignificant mercury content (e.g., maintenance dredging, TXDOT dredging). This placement will occur at some time in the future and is not part of Phase 1 of the Dredge Island stabilization construction project.

- Erosion Protection on the Final Cover - The future final cover will have gentle slopes so that the runoff resulting from rainfall events in the interior of the CDF will have low overland flow velocities. These low velocities will minimize the erosion of the cover material by the rainwater runoff. Additionally, a small area immediately surrounding the discharge structure will be excavated to create a settling basin to allow ponding of the runoff prior to release. This ponding will allow suspended cover material to settle out of the runoff before it is discharged.

- Drainage Structures - The dredge decant structures will be retrofitted to function as stormwater drainage structures.

Section 4 of *Volume 4* deals with the components of the Phase 1 construction that require periodic inspections and maintenance, including the following:

- Access bridge from mainland to northern shore of Dredge Island;

- The 10,500 lineal feet of the Alcoa CDF containment dikes;

- The storm protection on the Alcoa CDF dike exterior, including the armor layer, underlayer and dike toe protection;

- The gravel erosion protection on the exterior dike slopes above the armor protections and the interior dike slopes above 26.5 ft (NGVD 1929);

- The 25-ft. long concrete emergency spillway;

- The two dredge decant structures including the discharge structures;

- The two waterstops installed in the CCND CDF dikes; and

- The road on the Alcoa CDF dikes.

1.4 Post-Closure Care Requirements

This section describes general operation and post-closure care considerations for the Alcoa CDF on Dredge Island.

At a minimum, Alcoa needs to maintain copies of all reports of inspections performed by Alcoa or other independent parties, field reports documenting inspections, and in-house records such as laboratory results and contractor's logs.

1.4.1 Operation Requirements

Placement of dredge material into the Alcoa CDF will be conducted in accordance with Alcoa's USACE dredge permit. Specifically, Alcoa will require the dredge contractor to meet the State of Texas specified limit (5µg/L) in the USACE dredge permit for decant water discharges.

Water discharge practices should be conducted to minimize freestanding water within the Alcoa CDF. During both dredge placement and rainfall runoff management, the weir boards in the decant structures should be installed to ensure the water elevation within the Alcoa CDF is maintained at the lowest elevation without causing excess sediment discharge, and that the water level never rises above 28.5 ft (NGVD 1929). This can be accomplished by keeping the elevation of the weir boards in the decant structure at an appropriate elevation.

Improper management of both the Alcoa CDF and CCND CDF is likely to have dire consequences. During dredge placement and/or and other future operations, the following issues should be taken into consideration:

The south dike of the Alcoa CDF forms the north boundary of the CCND CDF. Malfunction of the waterstop and subsequent failure of the CCND CDF dikes can result from removing cover soil or exposing or damaging the HDPE liner.

Allowing water to stand in either the Alcoa CDF or CCND CDF for extended periods of time will cause saturated soil conditions in the inundated slopes. These conditions can lead to rapid drawdown failures of the slopes when the water level is lowered too quickly. Water levels in both the Alcoa CDF

and the CCND CDF should be minimized at all times. Ponded water should be drained from within the CDFs, as soon after it occurs as possible, to prevent excessive saturation of the dikes. Sudden drawdowns of ponded water should be avoided because they have the potential to cause dike failure.
Dredge pipe discharges should be placed such that they do not cause damage to either the Alcoa CDF dikes or CCND CDF dikes.

In addition to the above considerations, future dredging plans should include the following:
Coordination of dredging operations in both the Alcoa CDF and CCND CDF; and
Periodic inspections of the containment dikes (particularly in the area of the waterstop) before, during and after dredge placement operations.

A registered professional engineer should review the operating plans for the CDFs to determine whether they are appropriate for maintaining the safety of the CDFs.

1.4.2 Closure Requirements

Future dredge material placed into the Alcoa CDF should be aggressively dewatered and consolidated to maximize available capacity. Four feet of clean fill will then be placed on top of the dredged material. The future final cover for the Alcoa CDF may consist of a 4-feet thick dredge material cover, hydraulically placed, taken from an area of Lavaca Bay that has an insignificant mercury content (e.g., maintenance dredging, TXDOT dredging). This placement will occur at some time in the future and is not part of Phase 1 of the Dredge Island stabilization construction project. This will bring the final cap to a relatively flat elevation of 26.5 feet (NGVD 1929).

The future final cover should be placed such that it has gentle slopes so that the runoff resulting from rainfall events in the interior of the Alcoa CDF will have low overland flow velocities. These low velocities will minimize the erosion of the cover material by the rainwater runoff. Additionally, a small area immediately surrounding the discharge structure will be excavated to create a settling basin to allow ponding of the runoff prior to release. This ponding will allow suspended cover material to settle out of the runoff before it is discharged.

4.0 SITE INSPECTION AND MAINTENANCE

4.1 General

This section of *Volume 4* addresses minimum inspection and maintenance procedures to be followed throughout the active life of the Phase 1 CDF. This section of *Volume 4* should be revised to cover the post-closure period after the final cover (four-foot thick clean dredge material) has been installed. Maintenance will be performed only on an as needed basis on these elements found to be deteriorating or in need of repair during the inspections.

The health and safety requirements for inspection and maintenance activities are provided in Appendix F (Site-Specific Health and Safety requirements) and Appendix G (Alcoa's facility emergency response procedures).

4.2 Removal Action Plan Phase 1 Inspection Frequency

The following items will require periodic inspection and maintenance:

- Dredge Island in general;
- Access bridge from mainland to northern shore of Dredge Island;
- 10,500 lineal feet of the Alcoa CDF containment dikes;
- Storm protection on the Alcoa CDF dike exterior, including the armor layer, underlayer and dike toe protection;
- Gravel erosion protection on the exterior dike slopes above the armor protection and the interior dike slopes above 26.5 ft (NGVD 1929);
- 25-feet long concrete emergency spillway;
- Two dredge decant structures including the discharge structures;
- Road on the Alcoa CDF dikes;

- Two waterstops installed in the CCND CDF dikes; and
- Reflectors and station tags.

A list of potential inspection items associated with each of the above elements is presented in Figure 4.1 – Schedule for Inspections. The inspection schedule is approximate, and all inspections may not result in written documentation unless problems are found. Maintenance will be performed only on an as needed basis on these elements found to be deteriorating or in need of repair during the inspections.

To assist in problem documentation, station numbers have been placed on reflector posts approximately every 500 feet along the dike. Figure 4-2 – Station Number Locations shows where the station numbers are located.

4.3 Inspection Reporting

An inspection log with explanations of observations made will document each inspection and become part of the operating records for the Dredge Island.

Inspection logs will be in a checklist/fill-in-the-blank format. A typical inspection log is shown in Figure 4-3 – Typical Inspection Log. All site inspection reports will include the date, place, time, weather, and names of individuals conducting the inspection. The log is formatted to ensure a specific itinerary is followed and that all pertinent facilities are inspected. The log also includes a checklist of typical problems associated with each item to be inspected. Blank spaces are provided to record observations, comments, and corrective actions implemented. The inspection logs will be supplemented, as necessary, with photographs, written reports documenting failures and mitigating actions taken.

The inspection logs will be maintained in a permanent binder. Separate written reports documenting maintenance activities and repairs shall be recorded together with these logs. These inspection and maintenance logs are of utmost importance to provide a post-closure case history for the Dredge Island.

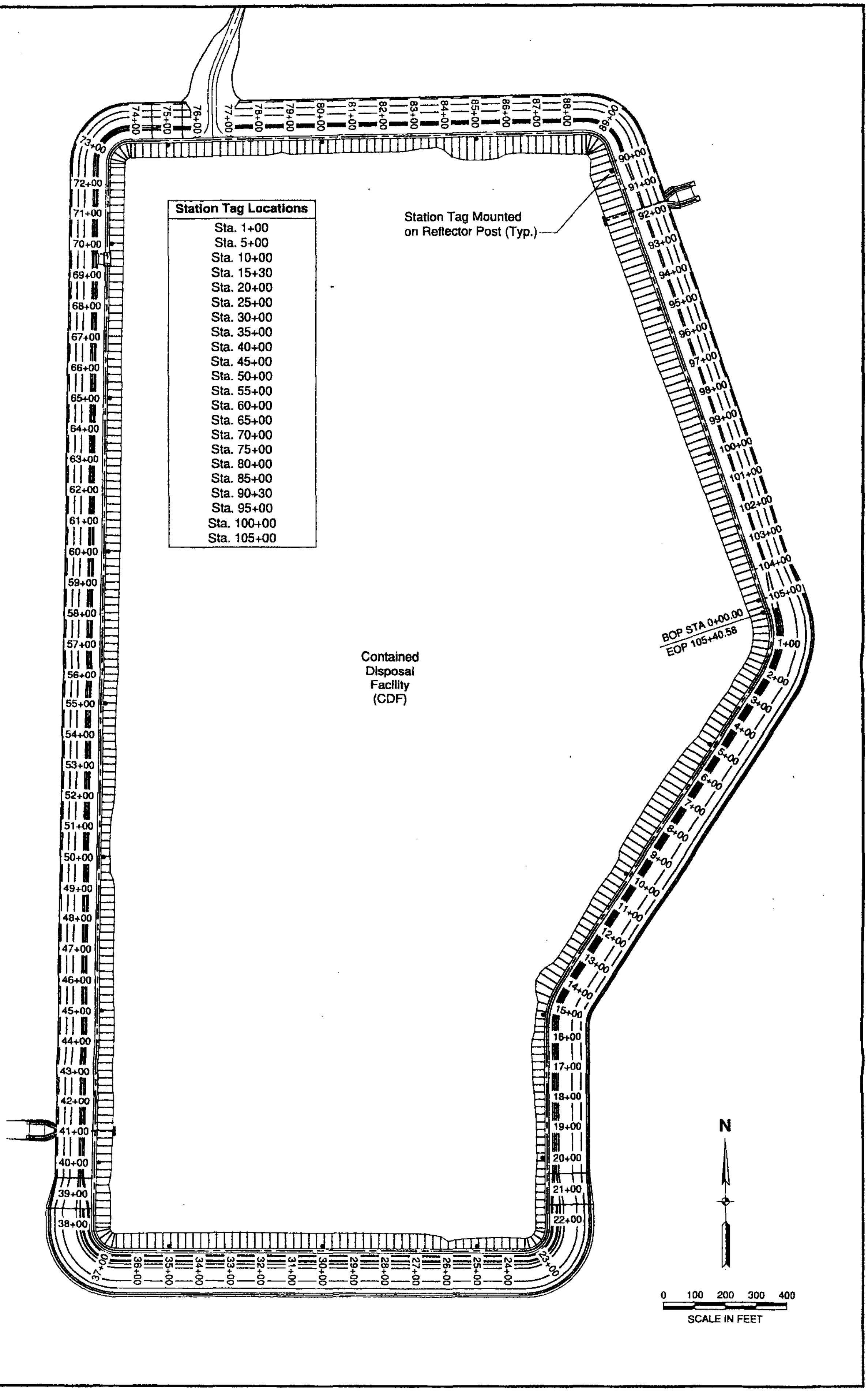
Preventative/non-emergency maintenance shall be completed as soon as practical to preclude further damage and minimize the need for emergency corrective action. If a hazard is determined to be

Specific Item	Typical Problems	Minimum Suggested Visual Frequency[1]: Monthly	Quarterly	Biannually	Annually	After Storm	Daily During Dredge Placement	Notes
General Dredge Island	Erosion		✓			✓		Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Deterioration		✓			✓		
	Settling/Ponding		✓			✓		
	Uplift		✓			✓		
	Washouts		✓			✓		
	Rodent Holes		✓			✓		
Access Bridge	Deterioration		✓			✓		Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Damage		✓			✓		
	Navigation Lights	✓				✓		
CDF Dike	Erosion		✓			✓	✓	Written reports will be made if problems are encountered. Maintenance to be performed as required. Trees and shrubs on dikes should be removed.
	Deterioration		✓			✓	✓	
	Damage		✓			✓	✓	
	Vegetation	✓						
Stone Storm Protection	Erosion			✓		✓		Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Settlement			✓		✓		
	Stone Deterioration			✓		✓		
	Stone Movement			✓		✓		
	Fabric Exposure			✓		✓		
	Damage			✓		✓		
Gravel Erosion Protection	Erosion		✓			✓		Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Fabric Exposure		✓			✓		
	Deterioration		✓			✓		
	Damage		✓			✓		
Emergency Spillway	Obstructions			✓		✓	✓	Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Cracks in Concrete			✓		✓	✓	
	Deterioration			✓		✓	✓	
	Damage			✓		✓	✓	
Decant Structures	Weir Board Elevation						✓	Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Depth of Water						✓	
	Obstructions			✓			✓	
	Deterioration			✓		✓	✓	
	Rust/Corrosion			✓				
	Damage			✓		✓	✓	
	Overflow Quality						✓	
	Overflow Quantity						✓	
	Flap Gate			✓		✓	✓	
Gravel Road	Potholes		✓			✓		Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Ponding		✓			✓		
	Deterioration		✓			✓		
	Washouts		✓			✓		
Waterstops	Erosion			✓		✓	✓	Written reports will be made if problems are encountered. Maintenance to be performed as required.
	Membrane Exposed			✓		✓	✓	
	Deterioration			✓		✓	✓	
	Damage			✓		✓	✓	
Reflectors	Intact/Reflecting				✓			Written reports will be made if problems are encountered.
Station Tags	Intact/Legibility				✓			Maintenance to be performed as required.

Notes:
(1) Increase frequency of inspections as necessary.
(2) File all completed inspection logs and maintenance requirements.

FIGURE 4-1

SCHEDULE FOR INSPECTIONS



Station Tag Locations
Sta. 1+00
Sta. 5+00
Sta. 10+00
Sta. 15+30
Sta. 20+00
Sta. 25+00
Sta. 30+00
Sta. 35+00
Sta. 40+00
Sta. 45+00
Sta. 50+00
Sta. 55+00
Sta. 60+00
Sta. 65+00
Sta. 70+00
Sta. 75+00
Sta. 80+00
Sta. 85+00
Sta. 90+30
Sta. 95+00
Sta. 100+00
Sta. 105+00

FIGURE 4-2
STATION NUMBER LOCATIONS

J:\4409\consl\compr\report\Drawings\A1348-3.dwg

SITE INSPECTION LOG Inspector's Name:________ Weather:________ Temperature: ________		Inspector's Signature:________ Date:________ Time Begin:________ Time End: ________ Sheet:____of____		
Specific Item to Inspect	**Typical Problems Encountered**	**Conditions Observed**		**Comments or Corrective Action(s) Implemented and Dates**
		Normal	**Abnormal**	
General Dredge Island	Erosion Deterioration Settling/Ponding Uplift Washouts Rodent Holes	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	
Access Bridge	Deterioration Damage Navigation Lights	☐ ☐ ☐	☐ ☐ ☐	
CDF Dike	Erosion Deterioration Damage Vegetation	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	
Stone Storm Protection	Erosion Settlement Stone Deterioration Stone Movement Fabric Exposure Damage	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	
Gravel Erosion – Protection	Erosion Fabric Exposure Deterioration Damage	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	
Emergency Spillway	Obstructions Cracks in Concrete Deterioration Damage	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	
Decant Structures	Weir Board Elevation Depth of Water Obstructions Deterioration Rust/Corrosion Damage Overflow Quality Overflow Quantity Flap Gate	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	
Gravel Road	Potholes Ponding Deterioration Washouts	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	
Water Stops	Erosion Membrane Exposed Deterioration Damage	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	
Reflectors Station Tags	Intact/Reflecting Intact/Legibility	☐ ☐	☐ ☐	

FIGURE 4-3

TYPICAL INSPECTION LOG

imminent or has already occurred during the course of the inspection or any time between inspections, corrective action shall be implemented immediately with notification of the appropriate authorities.

4.4 Specific Inspection and Maintenance Objectives

A discussion of specific inspection and maintenance objectives and schedules for each item addressed in Figures 4-1 to 4-3 is presented in the following paragraphs.

4.4.1 Island in General

Inspection of the Island in general will be conducted during the routine inspections. Typical observations should include:

- Erosion gullies or rapid shoreline erosion;
- Sideslope sloughing (slippage); and
- Settling/subsidence areas;
- Causes of vegetation deterioration; and
- Rodent holes/mounds.

Locations where deficiencies are found shall be sketched with reference to easily distinguishable site features.

Routine maintenance activities related to the items identified above may include filling ruts and gullies in eroded sideslope areas, and regrading common fill to match design conditions.

Localized subsidence or surface depressions (visual or as evidenced by the presence of ponded water following a rain event) may require backfilling and regrading to protect from possible failure of the dikes, re-establish final grading, and to ensure proper drainage.

4.4.2 Access Bridge

The access bridge will be inspected regularly for signs of structural deterioration, damage due to major storm events, sinking, and debris. All structural components of the bridge should be inspected for signs of deterioration, including the bridge deck, stringers, pile caps, and piles. Any deficiencies noted should be given immediate corrective attention so that the bridge will remain in satisfactory condition to allow heavy equipment access for the post-closure care activities.

The navigational lighting installed on both sides of the bridge at approximately mid-span should also be inspected on a monthly basis and maintained in proper working order.

4.4.3 Alcoa CDF Dikes

The inspection of the CDF dikes should include visual observation of the inside and outside faces of the dikes as well as the top. Any damage or erosion to the dike or the rock armor should be noted and repaired immediately.

During initial fill with dredge material, carefully check seepage conditions at toe of dikes. On a regular basis during initial fill placement, visually inspect all around the exterior of the dikes and examine the toe for large amounts of seepage that may indicate a problem.

Check water level in the Alcoa CDF and minimize water accumulation during dredging operations to prevent seepage problems.

4.4.4 Stone Storm Protection of the Dikes

Inspections of the stone storm protection should include visual inspection of the underlayer (where visible), the armor layer, and the toe protection. The inspection should include visual observation for potential settlement, stone movement, or undermining by erosion.

4.4.5 Gravel Erosion Protection

Gravel erosion protection should be inspected for movement in the gravel and exposed filter fabric.

4.4.6 Emergency Spillway

The emergency spillway should be routinely inspected for any breaks in the concrete that may lead to future failure, and areas where undermining might have occurred. Any damage should be repaired in a timely manner.

Routine maintenance involves removing any accumulated debris or sediment from the spillway that might obstruct flow.

4.4.7 Decant Structures

Decant structures should be inspected by examining the weir boards and walkways to the weir structures, particularly after major storm events. Drainage swales and outfall structure discharge flap gates should be routinely checked for proper operation, particularly after storm events, and should be kept clear of debris and sediment accumulation.

The steel components of the decant structures should be examined for rust and corrosion. Any deterioration of the steel should be repaired as needed at the earliest convenience of the owner.

4.4.8 Service Road

The access roadways will be inspected regularly for signs of deterioration, potholes, washouts, ponding/poorly-drained areas, and debris. Any deficiencies noted should be corrected as required to ensure that the road will remain in satisfactory condition to allow the safe operation of equipment. It should be recognized by inspectors that roadway deterioration may be a sign of underlying dike problems.

4.4.9 Reflectors and Station Tags

Reflectors and station tags should be inspected periodically to make sure they are intact and functioning properly. Inspectors should examine if reflector posts are upright and if reflectors are turned perpendicular to the road. If the reflectors are broken or their reflecting properties have deteriorated significantly, the reflectors should be replaced.

Station tags are located on the reflector posts at approximately 500-feet intervals around the Alcoa CDF dikes as shown on Figure 4-2. The station tags should be inspected to make sure they are intact and legible.

4.5 Final Inspection and Maintenance Requirements

After final closure, Alcoa will review the current regulations on post-closure care and develop revisions to this section of *Volume 4* that comply. Throughout the post-closure period, Alcoa will:

- Maintain the integrity and effectiveness of the final cap, dike stability, dike armor, and soil cover systems, including making necessary repairs to the any of the above, to correct the effects of settling, subsidence, erosion, or other events.

- Prevent run-on and run-off from eroding or otherwise damaging the final cap, dike armor, or final grading conditions.